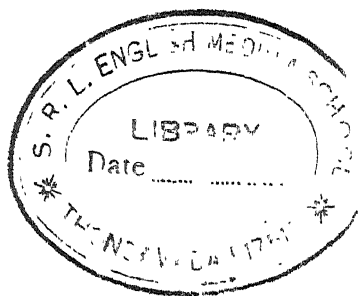




PART I  
CONTINENTS AND COUNTRIES







## I. THE FIELD OF GEOGRAPHY

THE word Geography implies a description of the earth. That is a large subject. But some knowledge of it is necessary in many directions of learning.

Our first reason for studying it is to learn something of the natural conditions in which man lives, and of the ways in which those conditions influence his ways of life. In different parts of the world men wander about or are settled in fixed homes (as we are) ; some live lives almost as wild as those of animals ; others practise arts, study sciences and apply them—they are, in a word, civilized. They divide their lands into states and set up governments ; they cultivate the soil, dig minerals, and manufacture many things ; they build towns, roads, and railways, sail the seas in ships, fly in the air, carry on commerce, one country with another. It is the business of geography to describe in what parts of the world they do these things—where are the great states and towns which men have set up ; where the main lines of trade and travel—and in what parts they cannot do these things. And so far as it is due to natural conditions that they can or cannot, geography should show why.

We have said that geography implies a description of the earth. The earth-ball moves through space around the sun ; its movements give us night and day, and the seasons of the year ; it is a part of geographical knowledge to know how this happens. The surface of the earth is divided into land and sea ; it is a part of geographical knowledge to know how land and sea are distributed and themselves divided, and how maps are made to show this. The surface of the solid earth is shaped into various forms, from ocean basins to flat plains and high mountains, and it is made of various rocks : the science of geology is concerned in detail with these things, but geographical knowledge is necessary to that science. And to other sciences too. Thus, the land-surface is covered (in part) with vegetation—trees and plants, and different kinds of them. Botany is the science which deals with these, but the geography of the chief sorts of vegetation must be known—that is, their distribution, or where they are found, over the land-surface. (Distribution is a

tions.) The *végétation* of any land, and also its animal life—of which the special science is zoology—depend greatly upon its climate. Meteorology is the science of the movements of the atmosphere which surrounds the earth-sphere, and of the climate and weather connected with those movements, and of their causes ; but geography must show in what parts of the world different sorts of climate are found. Oceanography is the science of the sea—its movements, the composition of its waters, the life that is in them ; geography is closely connected with this science.

All these features—land-forms, the seas, climate, vegetation, animal life—are studied in geography as regards their distribution over the earth's surface, and as they are related one to another, and as, in particular, they are related to man and his various ways of life.

By way of introduction, that is enough. Put shortly thus, it may seem hard of understanding ; but these are the general ideas to keep before us. And at least it is not difficult to think of reasons why geographical knowledge, according to these ideas, is useful. It points the direction, as we have seen, to the study of various sciences. It forms an introduction to a knowledge of the world of to-day, which, as citizens of an empire with territories all over the world, we ought to have. Geographical knowledge is no less necessary to the study of history, because natural conditions have affected men in the past as much as now, or more ; though not always in the same ways. And lastly, the earth is worth knowing for its own sake. It is worth having the sense of interest in scenery, even if one never sees much of it ; for the earth's surface is in far greater part beautiful than ugly, and its beauties are manifold and varied. We cannot see them all for ourselves, but there are many books of travel and other books about countries we may never see, and pictures in them, which are good to read and look at if this is done with some geographical knowledge. Such reading will add to that knowledge.

## II. THE BRITISH ISLES

WE begin our geographical view of the world in which we live, by considering the chief points in the geography of the British Isles, making a summary to which many who read this will be able to add more facts from other sources. And this should be done : for the geography of the British Isles is full of variety in detail—variety of surface, scenery, climate, vegetation, and natural products ; and this results in variety, also, in the occupations of the people and their ways of life.

*Position : The British Seas.*—The British Isles of Great Britain and Ireland, with nearly 5,000 small islands neighbouring to them, stand in the Atlantic Ocean off the coast of north-west Europe. Great Britain consists of England, with Wales to the west of it and Scotland to the north of it. Branch seas of the Atlantic Ocean separate the islands from Europe and from each other. The North Sea washes Great Britain on the east, and separates it from the Scandinavian countries, Germany, and the Low Countries. The Straits of Dover connect the North Sea with the English Channel ; the straits and the channel separate England from France. Ireland is separated from Great Britain by the Irish Sea, which is entered from the ocean to the west by St. George's Channel in the south and by the North Channel in the north. Wales is separated from the south-west of England by the Bristol Channel.

The islands stand on the continental shelf of north-west Europe. The surrounding seas therefore are shallow ;<sup>1</sup> the Irish Sea, the English Channel, and the North Sea except toward the Scandinavian side, are rarely over 300 feet deep and often much less ; the Straits of Dover are not 200 feet deep. It is an exercise of some interest to imagine, from a map showing relief both below and above the sea, what the land area would look like if the sea fell 300 or 600 feet. And geologists can tell that in former ages there were no islands as we know them ; at one geological period, for instance, much of the

<sup>1</sup> A continental shelf is a part of the earth's surface, surrounding the continents, which is generally covered by sea of a depth of 100 fathoms (600 feet) or less. The European continental shelf is further considered on p. 79 ; cf. also Part II, p. 440, with fig. 153.

area now covered by the shallow seas consisted probably of a land of rolling hills, a part of the continent. Only to the west of Scotland and Ireland are the great depths of the ocean soon reached.

*The Map.*—It is a point worth remembering in learning the map of the British Isles, that the meridian of Greenwich ( $0^{\circ}$ ) cuts no land north of a point about midway on the east coast of England (north of the estuary of the Humber). The easternmost coast of England reaches nearly to  $2^{\circ}$  E. long.; the easternmost coast of Scotland only just beyond  $2^{\circ}$  W. The meridian of  $6^{\circ}$  W. cuts the westernmost promontories of the west coast of Scotland and some of the islands off it, and marks approximately the east coast of Ireland. That of  $10^{\circ}$  W. cuts the westernmost promontories of the west coast of Ireland. The southernmost point of England (Lizard Point, in the south-west) is on  $50^{\circ}$  S. lat.; the parallel of  $59^{\circ}$  N. cuts the Orkney Islands off the north coast of Scotland.

*Relief.*—The extent of the islands, then, is small; they are mere scraps of land in comparison with the vast dominions of the Empire of which Britain is the Home Land (p. 18). ‘From Land’s End to John o’ Groats’ the distance by road is only 900 miles. (These are points in the extreme south-west of England and north of Scotland respectively, and so the phrase is often used to express the whole length of Great Britain.) Yet the differences of structure and scenery within the islands are many, and much of the scenery is exceedingly beautiful, even though there be no tremendous mountains or other wonders on the grand scale found in other lands. A detailed contour-map in the atlas should suggest some of these differences. It shows the coasts to be smooth, and without high land behind, in some parts, especially the east; but in other parts broken and with high land close behind or rising straight from the sea, as in the south and west. It also suggests different types of highlands in different parts: here the form of a plateau with steep sides and fairly level top, shown by close contours at the lower levels, while the higher contours enclose wide areas; there, hills in ranges steep to the crests, shown by the higher contours enclosing long narrow strips.

To such features we must look presently, for the variety of land-form within our islands bears upon their population in regard to its

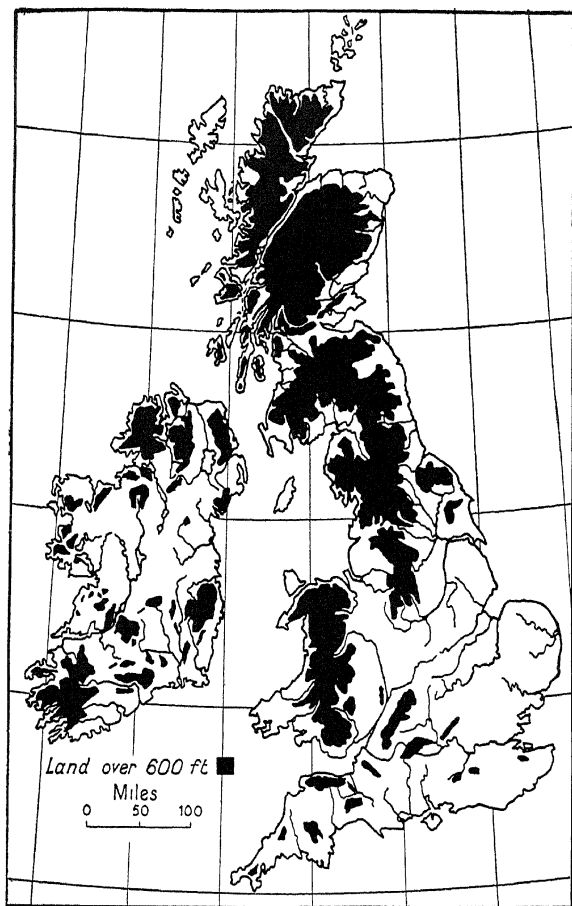


FIG. 1. THE BRITISH ISLES: the distribution of low land (white) and high land (black). This sketch serves as a simple guide to the more detailed physical map in the atlas.

suggested by a simple map (Fig. 1). From this it is seen that the widest lowlands in Great Britain are in the south-east, east, and midlands of England, and the principal highlands in the south-west of

Tees in the north-east of England to that of the Exe in the south-west, but it does not mark the division at all exactly. There are to be noticed, further (1) an extension of the English lowlands from the midlands to the west coast north of Wales; (2) the Scottish lowland, striking across Scotland from east to west, between hill-regions in the south and in the north. This lowland is continued northward in a

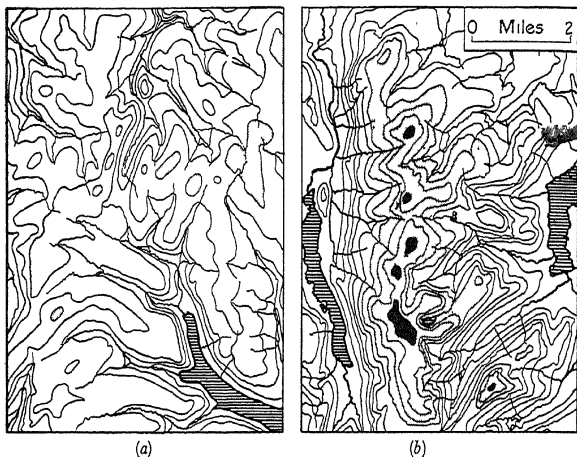


FIG. 2. A contrast between parts of the Welsh plateau (a) and the mountains of the Lake District of England (b). In (a) Lake Vyrnwy (shaded horizontally) is seen in the south-east; in (b) Lake Thirlmere (west) and part of Ullswater (east) with the summit of Helvellyn, shown by the largest black area, between. The contours show steep-sided narrow valleys in both districts, but gently rounded summits on the Welsh plateau, bolder, higher, and narrower ridges in the Lake District. Land over 2,000 ft. above sea-level is shaded, over 2,750 ft., black. (On contours generally see Part II, p. 419.)

narrow coastal belt on the east side of Scotland, but not on the west. Ireland is seen to be arranged on a different plan: a plain occupies the centre of the island, and is bounded, principally to the north and south, by detached groups of hills.

*The Ages of Rocks : Glaciation.*—Differences of relief and scenery suggest, what is the case, that the British Isles are built of rocks of many different kinds and ages. We need not consider this further, here, than to notice from figs. 1 and 3 that there is a relationship between the younger rocks and the lowlands on the one hand, the

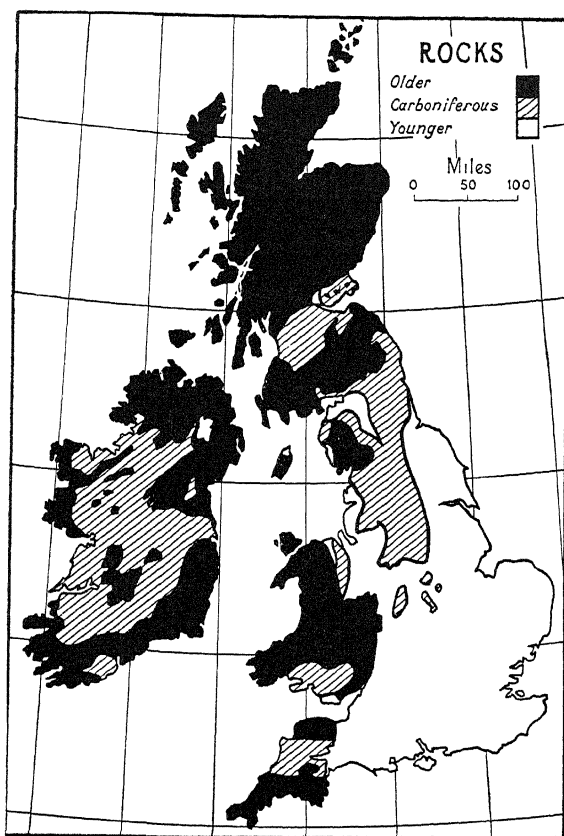


FIG. 3. It is seen by comparison with Fig. 1 that there is a general relation between highlands and older rocks, and between lowlands and younger rocks. The carboniferous rocks belong in part to highlands and in part to lowlands (contrast the Pennine district, Scotland, the central lowland of Ireland, &c.).

older rocks and the highlands on the other. Fig. 3 distinguishes the carboniferous series of rocks, which lie, roughly speaking, between young and old, and are of first importance because in some of them are found the valuable coals of England, Wales, and Scotland.

We have seen already that in former geological ages the British



Islands were part of a continental land-mass ; and many relations have been found between the rocks of these islands and of the continent of Europe. For example, the rocks on either side of the English Channel are broadly speaking the same, so that different kinds of rock are seen in the same order along the English and French coasts. And the very old rocks which are found over much of the Scandinavian peninsula are found also in the highlands of north Scotland and north-west Ireland. During the geological period called the Ice Age, glaciers spread over much of north-west Europe and covered what are now the British Isles as far south as the valley of the Thames in Great Britain, and all Ireland. It may be that the weight of the ice-sheets helped to depress the old mountain systems of which the Scottish and Irish highlands just mentioned are remains, and indeed the whole former continental region which included the islands. Among the signs of the action of glaciers now found in Britain are the smoothing and scratching of rock-surfaces in the highland districts. Mounds and banks of rock-fragments from the glacial moraines are often to be traced ; many lakes in the highlands are the result of the damming of river valleys by moraine deposits. And over much of the land north of the Thames, and in Ireland, soils are composed of the rocks ground and carried by the glaciers and glacial streams ; ' glacial drift ' (or simply ' drift ') is the term commonly applied to such deposits, typical of which is boulder clay, a clay sometimes full of boulders of rock. Glacial drift is found all over the British Isles, except south of the Thames, in the lower Severn basin, and in the eastern part of the English midlands. (See further Part II, p. 447, and compare Fig. 42.)

*Climate.*—The climate of the British Isles is controlled by their position in a northern region where westerly winds prevail, with the wide deep Atlantic Ocean to the west, but narrow and shallow seas, and then a continental land-mass, to the east. Generally the sea is cooler than the land in summer, and warmer than the land in winter. This is more markedly true of the ocean than of the shallow seas, because the shallow waters are more quickly affected by seasonal changes of temperature, from warm to cold, than deep waters through which changes of temperature take place more slowly. The general south-westerly drift across the Atlantic Ocean, sometimes called the Gulf Stream drift from the warm current off eastern North

America in which a part of it starts, is warm as it comes from southerly latitudes, and the air moving generally from west and south-west is warm for the same reason, and is kept so by its passage over the warm waters.

We may now consider the maps showing isotherms<sup>1</sup> for January, representing winter, and July, representing summer. These isotherms are lines drawn through points which have the same average

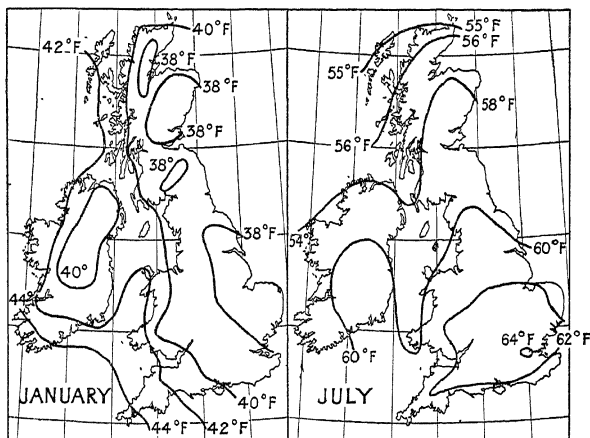


FIG. 4. WINTER AND SUMMER ISOTHERMS, from temperature observations reduced to sea-level (see Part II, p. 466).

temperature during the month, or would have, if they were all at sea-level. The averages are reduced to sea-level in order to make it easy to study general conditions from them. If they were not so reduced, we should find many differences according to the heights of the different points above sea-level; thus, on an average, for the whole year, the temperature at the top of Ben Nevis in the Scottish highlands (4,406 feet, the highest point in the British Isles) is a little over  $15^{\circ}$  F. lower than at sea-level, at its foot. The isotherms drawn, however, show the following important general features. In winter the warmest parts of the British Isles are the south-west of

<sup>1</sup> For general explanation of isothermal and other climate maps, see Part II, p. 466.

Ireland and England, and the west coast generally is warmer than the east. The coldest are parts along and behind the east coast of England and Scotland, and south-eastern England is as cold as north-western Scotland or even colder. A temperature map of the world shows that it is more usual for winter cold to increase from south to north. But the prevailing movement of warm air from the west keeps all the western parts (excepting highlands) warmer than the east, since the air is cooled in passing eastward over the cooler land. Moreover, east and north winds in winter come from colder lands and over colder seas. The isotherms for July suggest that in summer the south-east of England is hotter than any other part of the islands, and the decrease of temperature from south to north is seen, in a way in which it is not seen in winter. The influence of the westerly air-movement is towards cooling; the highest temperatures are usually accompanied by south-easterly or southerly winds from the nearest parts of the continent. We see that, broadly, there is a wider range of temperature, between summer and winter, in the east than in the west; and that the widest average range is in the east of England. But the equable nature of the climate is shown by the average temperatures illustrated on the maps, which in January show no large area with a mean temperature below  $38^{\circ}$ , and in July only one quite small area with a mean temperature above  $64^{\circ}$ . The average number of hours of sunshine is not high anywhere. It is highest, from 1,600 to 1,800 hours or even more, in a belt extending along the coast of eastern England from near the Wash, around the south coast, to the south-west. It is lowest in an area covering the highlands and valleys north of the midlands of England (in south-west Yorkshire and neighbouring counties), and over the lowland and interior highlands of Scotland, where the average number of hours is less—in parts much less—than 1,200. The north of Scotland, however, is far enough north for the sun, on the 'longest day' in summer, to be above the horizon for 18 hours or more, and there is no night-darkness. In midwinter the sun is above the horizon there for about six hours (compare Part II, p. 404).

The climate of Britain is equable as regards rainfall, as well as temperature. Rain falls at all seasons, and no part of the islands is very dry. A map (Fig. 5) illustrating mean annual rainfall shows that the highlands, on the whole, receive more rain than the low-

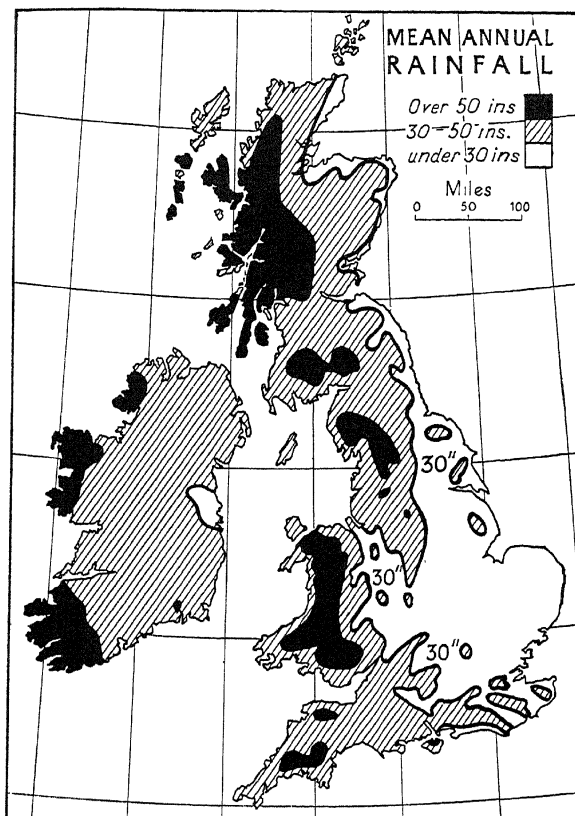


FIG. 5. From comparison with Fig. 1, a general relationship appears between high land and high rainfall.

lands, and that the wettest regions are the western highlands of Scotland, north-western England, Wales, the west and south-west of Ireland, and the south-west of England—all western districts, that is. The driest parts are seen in the east and south-east of England; also, eastern Scotland and eastern Ireland have less rain than their western parts. The main line showing 30 inches of rainfall, running from the

south-east of England to the north-east of Scotland, is specially helpful ; it goes near to marking off lowlands from highlands, and it has a connexion with agriculture which we shall see later. It will be noticed further that only a small part of Ireland, in the east, has a rainfall less than 30 inches ; that island, as a whole, has a more equal distribution of rain than Great Britain. The western highlands in both islands, however, show large areas over which the average rainfall exceeds 60 inches. The wettest districts, such as the highlands in north-west Wales (Snowdon district), the Lake District of north-western England, and the western highlands of Scotland (e.g. Ben Nevis), at some points receive from 150 up to 200 inches of rainfall a year ; the driest part of the eastern midlands of England receives, on an average, about 23 inches.

The changeable weather which causes the inhabitants of the British Isles usually to talk about it when they meet, is mainly connected with the passage of depressions (cyclones, or low-pressure systems) across that part of the Atlantic Ocean in which the islands lie. These depressions nearly always travel in some easterly direction. They occur at all seasons, but are deepest and most frequent in winter. Gales are commonest then—from October or November to February or March. The phrase ‘ equinoctial gales ’ is often heard, in relation to the autumn equinox toward the end of September ; gales, however, are not specially frequent then, but the season is that of transition from autumn to winter conditions. A common sequence of weather in winter is a change from cold to warmth, when, as a depression advances, a tongue of warm southerly air projects into a front of cold northerly air. The warm air is lighter and tends to rise over the cold, and its moisture is condensed into cloud and steady rain, interrupted perhaps by a period without rain when the southerly air is no longer rising. As the depression passes, there comes a zone along which the southerly air gives place again to northerly ; temperature falls, the air becomes unstable, steady rain gives place to showers, and squalls are frequent ; then the weather clears unless another depression follows immediately. Such is a common sequence of weather on the southern side of a depression passing eastward—and the most common track of the centre of a depression, in winter especially, is to the north, or across the north part, of the British Isles. With an anticyclone or high-pressure system estab-

lished over the islands, we have usually fine bright weather in summer, though it may be cloudy without heavy rain ; in winter this is more usual than bright weather. Hard frosts in winter, lasting for any long period, usually come with the cold easterly winds from the continent of Europe, not much warmed in crossing the narrow and shallow North Sea.<sup>1</sup>

*Vegetation.*—Britain is in the temperate forest belt of the northern continents, and was formerly well wooded with oak, ash, beech, and other deciduous trees, except in the north, where the forests were of pine (coniferous). A pine was, and to some extent still is, also characteristic of sandy soils in south-eastern England. Not more than a twenty-fifth part of the total area is woodland now. In centuries of occupation by a large population trees have been cut down for timber and to free the land for agriculture. The word ‘ forest ’ still appears in some English districts where, though still well wooded, the woods were formerly much more extensive than they are now. Thus we find the New Forest in the south, Epping Forest near London, the Forest of Dean in the west, Radnor and Clun Forests on the Welsh border, the Forest of Arden, Charnwood Forest, and Sherwood Forest in the midlands. And in the north of Scotland the term ‘ forest ’ is still used of bare hill-tracts, notably those where wild deer still flourish, which are spoken of as deer forests. Man has never made a practice of planting trees to replace those he has destroyed, and it is only in recent times that afforestation (that is, the planting of new woods) has been carried out at all regularly. It is done now to some extent on lands not too valuable as agricultural lands, and not too poor, or unsuited by climate, for trees. The trees planted are generally conifers, for they grow fairly fast and are valuable in commerce. In spite of the former destruction of trees, much of the English lowland, and smaller districts elsewhere, are still very well wooded ; and with their noble trees, their close-set hedges, bright grass and pleasant wild flowers such districts are very beautiful, and there is nothing quite like them anywhere else in the world. About a quarter of the whole area of the British Isles is cultivated for crops,

<sup>1</sup> Climate is considered generally in Part II, Chap. xv. Further reference to the structure of depressions will be found there, and at the end of the chapter comparative temperature and rainfall figures for various parts of the world may be used in conjunction with the sections on climate in Part I.

and over a half is grass land. This varies from the rich, vivid green grass-fields of the English lowlands and Ireland to the short darker grass of the hills. Forests when decayed or destroyed give place to heath or scrub when the land is not cultivated, and much of the highlands are moorlands. In many parts peat moors or peat bogs are found; they are specially characteristic of wet cool lands such as Ireland. Peat is vegetation decomposed by water and partly carbonized—that is to say, its formation is a first stage in the formation of coal—and it is used freely as fuel in Ireland and other districts where it is found.

*Government.*—England, Wales, and Scotland are directly under the government of the imperial parliament, which meets at Westminster in the capital, London. The State of Northern Ireland sends members to the imperial parliament, but has also its own parliament, meeting at Belfast. The Irish Free State, of which the capital is Dublin, has its own parliament and does not send members to the imperial parliament. The Free State has the same standing as the self-governing Dominions of the British Empire. The Isle of Man in the Irish Sea, and the Channel Islands in the English Channel, have parliaments of their own.

*The British Empire.*—The self-governing Dominions are Canada, Australia, New Zealand, and South Africa; besides these, there are under the British Crown the Empire of India, and many colonies, dependencies, and protectorates, including mandated territories: that is to say, countries over which British control has been established at the mandate or bidding of the League of Nations. The British Empire covers an area of about twelve million square miles—nearly a quarter of the land surface of the earth. As for the British Isles, the areas, in round figures, are: England 51,000 square miles, Wales 7,500, Scotland 30,500, Ireland 31,800. The populations are: England 36 millions, Wales  $2\frac{1}{4}$  millions, Scotland under 5 millions, Ireland under  $4\frac{1}{2}$  millions. Thus if the populations were equally distributed in each division, England would have over 700 people on each square mile, Wales less than 300, Scotland 160, Ireland less than 140. Of the two divisions of Ireland, however, Northern Ireland, with only 5,200 square miles, has a density of population of more than 240 people per square mile; the Irish Free State, with 26,600 square miles, has barely 120. This unequal distri-

bution has happened largely on account of geographical conditions which we shall presently notice : they are connected with the facts that England has the greatest mineral wealth—in coal, mainly—on which have been founded big manufactures carried on in many large towns, and that England has the largest extent of rich agricultural land. Scotland and Wales have mineral wealth and manufactures also, but less widely distributed ; Ireland has no minerals of first importance and only one large manufacturing district, in the north-east around Belfast. Scotland, Wales, and Ireland have each a larger proportion than England has of highland or other land which, for agriculture, is useless or nearly so.

We should keep in mind, too, certain reasons connected with geography which (among others) have caused Britain to become the home-land of an empire. Great Britain is an island of which no part is very far from the sea. Many of its people live on or near the coasts, and many, from early times, have been sailors. Long ago some of them began to adventure far over the seas, discovering new lands, taking possession of them for Britain, and founding colonies. Useful plants, precious minerals, gems, and many other things not produced at home were brought by sailors, and came gradually into trade. As the population of Britain grew, not even enough necessities such as wheat and wool could be produced at home ; moreover, products of tropical lands such as tea, coffee, cotton, and rubber became necessities also. Britain, becoming one of the leading manufacturing countries in the world, was, and is, able to send to the other countries of the empire manufactured goods in exchange for raw materials and foodstuffs. Not that British commerce is wholly, or even mainly, with other countries of the empire ; but imperial commerce is of immense and growing importance (see further, p. 48). Within the empire are lands of vast extent but thinly peopled, such as Canada and Australia, including regions of temperate climate in which white men can do hard work ; and almost all the inhabitants of those lands are white. In South Africa also white men can labour, but there also are large numbers of natives, who do the harder work for the whites. In other great divisions of the empire, such as India and the British territories in tropical Africa, the climate is usually too hot for people from Britain to do heavy work, and in such lands a small number of white men govern, and direct the work



of, a very large number of natives, who are accustomed to the climate. The temperate lands of the empire have attracted many emigrants from Britain, whether from overcrowded cities or from agricultural lands too poor to support growing populations. But there is room in these overseas dominions for many millions more. We have found the population of the British Isles to be something over 47 millions. The white populations of the whole of the rest of the empire do not amount to more than about 17 millions. (The native populations are estimated at about 370 millions, of which the population of India represents well over four-fifths.) The majority of the white populations are people from Britain or else their descendants, so that Britain is called Home, even by many who have never been there.

The importance of the variety in the geography of the British Isles, which we have noticed already, is now seen again. If the islands had consisted only of plain land like the Fen country or central Ireland, or of highlands like those of Scotland, the inhabitants would have been few and mostly given to agriculture or pasturing. Britain might then have been an unimportant possession of some European country : certainly it would not have become the motherland of an empire.

*Boundaries : the Welsh Marches.*—The frontier between England and Wales, known as the Welsh Marches, runs through a country transitional between the Welsh highlands and the lower-lying English Midlands. The boundary line starts, in the south, on the west side of the estuary of the river Severn, which might have formed a more natural boundary between England and South Wales. For this reason the county of Monmouth, also on the west side of the estuary, though politically English, is reckoned with Wales for some purposes. The boundary strikes northward to the high moorland of the Brecon Beacons and the Black Mountain, keeping largely to waste, uninhabited land, and crossing instead of following two important river-valleys, those of the Usk and the Wye. It then passes along the eastward slopes of the highlands in the district of Radnor and Clun Forests, reaching the upper valley of the river Severn, which it crosses, skirts the eastern slopes of the Berwyn Hills, and reaches the lowland in the basin of the Dee. This is divided between England and Wales, the boundary reaching the coast at the head of the Dee estuary.

*The Scottish Border.*—The boundary between England and Scotland passes through a district commonly known, from this fact, as the Border. It starts at the head of Solway Firth, an inlet of the Irish Sea, following a small river over the Solway Plain which borders the firth, and then striking up the Liddel valley to the Cheviot Hills, which it follows north-easterly along their bare, deserted crests. Near their end on the summit called The Cheviot it turns downward to the valley of the Tweed, and follows the lower course of that river nearly to its mouth in the North Sea ; but the town of Berwick, at the mouth, is not included in Scotland.

We notice this point common to the Scottish border and much of the Welsh marches—that the boundary line passes through country little inhabited or not at all. That is a feature worth looking for in studying any boundary lines, for it is common, though of course not at all invariable. The boundary line itself may mean little, especially in warfare ; but a border, march, or frontier land not fitted for close population forms a good natural division between one people and another, and in early times was often a protection against enemies.

The boundary between Northern Ireland and the Irish Free State has no well-marked natural features to follow throughout, and it has been disputed in modern times. We shall have to refer to it again in studying Ireland.

*Local Government.*—For their local government Great Britain and the Irish States are divided into counties. These divisions were first formed in England, where some of them represent old kingdoms or tribal divisions, or districts surrounding strong places which formed centres for armies and governors. The old English word ‘ shire ’ was at first used of these divisions, and it still is used in many of their names, some of which we shall meet with in our description. It is commonly attached to the name of the county town, or centre of the old county—thus Yorkshire : county town, York ; Warwickshire : county town, Warwick. The word ‘ county ’ was brought in after the Norman conquest. The formation of counties was gradually extended over Wales, Scotland, and Ireland, and the word is used also of divisions in other English-speaking countries—dominions of the empire and the United States of America. The chief towns in Britain have local government independently of the counties ; other towns have their own government for some

but are included with their counties for others. The word 'city' has two applications in England: some towns are cities as containing the cathedral churches of bishoprics in the Church of England, and some of these are quite small towns; otherwise, the title of city is given to certain large towns of chief importance. London has grown so huge a town that the old City of London covers only a small area in its centre; the rest forms a county governed by a council, and is divided into boroughs, one of which (Westminster) is a city in itself.

From this point we will deal with the island of Great Britain first, and afterwards with Ireland.

### GREAT BRITAIN <sup>1</sup>

*Physical Divisions of England and Wales.*—It is now necessary to divide England and Wales into a larger number of physical divisions than the simple division which we made before, into lowlands and uplands. We shall consider these divisions:

- (1) The London basin and the eastern slope in East Anglia;
- (2) The chalk belts and the Weald of Kent and Sussex;
- (3) The Hampshire basin;
- (4) The clay valleys and the Fen country;
- (5) The central limestone belt;
- (6) The midland plateau;
- (7) The south-west;
- (8) The highlands of Wales;
- (9) The highlands of the Pennines;
- (10) The highlands of the Lake District.

*The London Basin* is the lower basin of the river Thames. This river in its course from the Cotswold Hills forms with its upper tributaries an upper basin, and then, through a gap between the Chiltern Hills and the White Horse Hills at Goring, enters its lower basin. Below Goring the Thames flows between flat banks, well wooded, past picturesque villages and a number of small towns, including Windsor with the King's castle. Near the western edge of

<sup>1</sup> In studying the physical features of Great Britain and Ireland reference may be made to Part II, Chap. xiv, which, in dealing with the shaping of the land-surface, cites various examples, such as the Weald (with Fig. 159), the southern escarpments (with Fig. 158), the Pennines, &c.

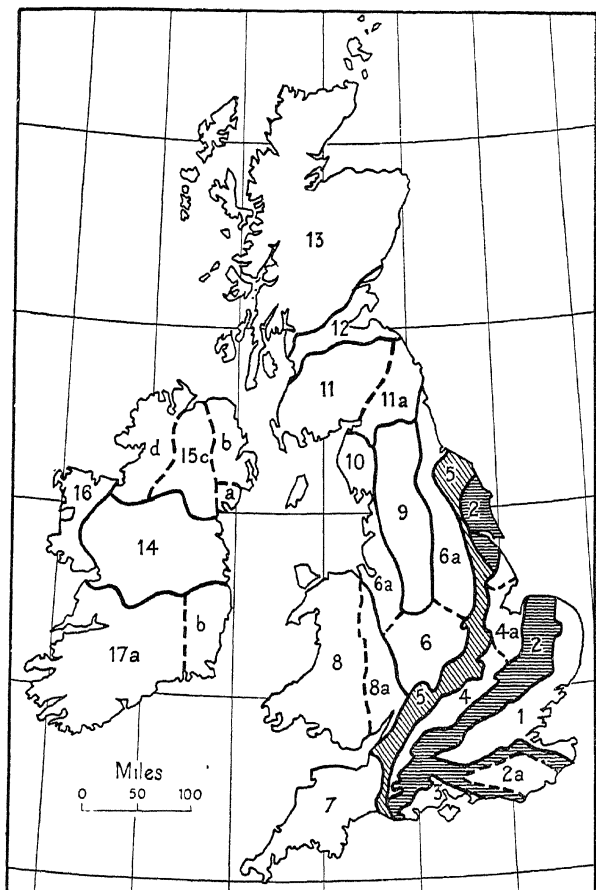


FIG. 6. PHYSICAL DIVISIONS OF GREAT BRITAIN AND IRELAND. (1) London basin and East Anglian slope. (2) Chalk belts and (2a) the Weald. (3) Hampshire basin. (4) Clay valleys, with (4a) the Fens. (5) Limestone belt (not carboniferous). (6) Midland plateau, with (6a) lowlands of Cheshire, Lancashire, and Yorkshire. (7) South-western England. (8) Welsh plateau and highlands with (8a) Welsh marches and lower Severn valley. (9) Pennines. (10) Lake District. (11) Southern uplands of Scotland, with (11a) the Border country (Cheviots). (12) Central lowland of Scotland. (13) The highlands of Scotland (bordered by narrow lowlands as suggested in fig. 1).

IRELAND: (14) Central lowland. (15) Northern highlands, &c.: (a) Mourne mountains, (b) Antrim plateau, (c) north-central uplands, (d) Donegal highlands. (16) Western highlands. (17) Southern highlands: (a) south-western, (b) south-eastern.

London the river becomes tidal and important for commerce, and below the city of London it is full of shipping and lined with docks. It widens into an estuary with flat shores, which opens into the North Sea fifty miles below London. The Thames above London affords pleasure for many who live in the capital and along its banks ; and in most parts of the London basin many people live whose work lies in London. To the north-east of the Thames estuary the coast is at first low, marshy, and indented with a number of shallow estuaries. Farther north it is less broken, and sometimes there are cliffs of soft rock, apt to be broken down and washed away by the sea. The eastward slope of East Anglia is a level or slightly hilly country richly wooded for the most part. In the north is the district of the Norfolk Broads, small lakes in a marshy country drained by rivers which enter the sea at Yarmouth. The Broads form a favourite pleasure resort.

*The Chalk Belts.*—The London basin is enclosed on the west by the Chiltern Hills and on the south by the North Downs, chalky hills which for the most part rise in smooth slopes covered with short grass and bearing fewer trees than the lowlands between them. The Chilterns, however, are covered in part with beech woods which extend to the neighbouring part of the Thames valley in Burnham Beeches. The chalk is porous and the surface generally rather dry, which partly accounts for the difference in vegetation as compared with the lowland, particularly marked in the district of the Weald in the south-eastern counties of Kent and Sussex. This is enclosed on the north by the North Downs, on the west by the Hampshire Downs, and on the south by the South Downs. The clay soils of the Weald, and especially the Forest Ridge in its midst, have a beautiful tree growth, remnants of ancient forest. The structure of this region is interesting and easily understood, and it is considered in Part II, p. 452. The rivers flow through gaps in the Downs northward to the Thames—for example, the Medway, which joins the Thames estuary—and southward to the English Channel. Several of these gaps are of importance as main lines of communication from the south and south-east to London. The North and South Downs are broken off in white cliffs at the coast ; otherwise the coasts of Kent and Sussex are generally low ; and some parts, especially Romney Marsh, were covered by the sea in historic times,

so that small towns such as Rye and Winchelsea are found, which formerly were important seaports.

The chalk belt extends northward from the Chiltern Hills as a low ridge as far as the north coast of Norfolk, where it is broken by the Wash, a shallow indentation of the North Sea. It appears again farther north in Lincolnshire. Another break is caused by the estuary of the Humber ; and then in the Yorkshire Wolds the chalk extends northward and eastward to the coast at Flamborough Head, where, as in Kent and Sussex, there are high white cliffs.

*The Hampshire Basin.*—The North and South Downs converge in the west to the Hampshire Downs and Salisbury Plain, a broad open plateau. From here the Dorset Downs extend westward, and to the south is the Hampshire basin, not unlike the Weald. It is penetrated by two arms of the sea, called Spithead and the Solent, which mark off from the mainland the Isle of Wight and converge in Southampton Water. Westward of this lies the New Forest already mentioned.

*The Clay Valleys and the Fen Country.*—Along the foot of the chalk belt, from Weymouth Bay on the coast of the English Channel to the Wash on that of the North Sea, there are valleys of clay soil, rich lands for agriculture and pasture. Among these is the upper basin of the Thames already mentioned. Toward the Wash the valleys of the Great Ouse and other rivers sink to a flat alluvial plain known as the Fens. This was formerly a region of marsh, and to some extent is still marshy, with a few low islands of firm ground such as that on which stands the small city of Ely, whose high cathedral towers are visible across the levels for many miles. Another such city is Peterborough, on a slightly rising site by the river Nene, formerly surrounded by marshland. This town has grown as a railway junction and a manufacturing and market centre ; but it was an early retreat of holy men, and here, as at Ely, there is a splendid cathedral. The fenland has been drained in somewhat the same way as the lowland of Holland on the other side of the North Sea. It is, as we have seen, in that part of the English lowland which is on an average coldest in winter, and with its many waterways it is famous for skating when these are frozen, again just as in Holland, though freezing is much less common than in that continental country.

*The Central Limestone Belt.*—Next to the west of the chalk belt and

the clay valleys a limestone belt extends from Portland Bill on the south coast through the Cotswold Hills, Edge Hill, the Northampton uplands and Lincoln Edge, and after being broken where the rivers of the Humber basin converge to that estuary, appears again in the Cleveland Hills of eastern Yorkshire. Short grass covers the heights, as upon the Downs, and the limestone is seen in the stone houses and the walls which divide fields instead of hedges. This is not the carboniferous, or coal-bearing, limestone; but the stone is valuable for building, and quarries at Portland and near Bath have supplied stone for many great buildings in London and other towns. The Isle of Portland is connected with the mainland by a curious bank of shingle called Chesil Bank (Part II, fig. 164), which shows how the sea carries shingle and, according to the strength of the currents, sorts it into different sizes of stones. The escarpment or steep slope of the limestone faces west, and the drainage is mostly east and south-east, in which direction the longer and gentler slopes lie. Besides the Thames and the Great Ouse a number of other rivers rise in these heights, and one of them, the Bristol Avon, cuts through the hills in a westward course to the estuary of the Severn.

*The Midland Plateau.*—The Cotswold Hills, Edge Hill, and the Northampton Hills have steep slopes north-westward toward the higher part of the lowland which is sometimes known as the Midland plateau. The Cotswolds and Edge Hill overlook the Vale of Evesham, which is watered by the Stratford or Worcestershire Avon, a tributary of the Severn. The name of Avon means, simply, water, and several English rivers bear it. The Midland plateau lies between the Avon, the middle part of the Severn on the west, and the upper valley of the Trent on the north. The plateau is broken by low hills such as Charnwood Forest already mentioned, the Clent Hills, and Cannock Chase ('chase' being a word signifying wooded land). We come in this division to the first of the manufacturing and mining districts we have met with, in the neighbourhood of Birmingham, the Black Country, and Cannock Chase.

*The River Severn* rises in Plynlimmon in the western part of the Welsh highlands, and with a curving course north-east, east, south-east, and south-west, enters the Bristol Channel through a wide estuary. It is the only one of the bigger English rivers which flows out westward, as the long slopes of the uplands we have so far described are

generally toward the east. The Severn and Thames are much the same in length, a little over two hundred miles, and in area of basin a little under six thousand square miles. Those who are concerned with historical geography will notice that whereas the Thames through most of its course forms a boundary between counties, the Severn does not. After passing out of Wales it flows successively through Shropshire, Worcestershire, and Gloucestershire, and only in the lower part of its estuary divides Monmouth from Somerset.

*The Cheshire Plain.*—To the north-west of the Midland plateau a wide passage between the Welsh Hills to the west and the southern end of the Pennine Hills to the east prolongs the lowland into the plain of Cheshire, north Shropshire, and south Lancashire. The Cheshire plain is noted, as we shall find, as agricultural and pastoral country and for the salt-mines which are worked beneath it, and in the north it passes into the great mining and industrial district of south Lancashire. It opens to the Irish Sea in the estuaries of the Dee and the Mersey, the one shallow and full of sandbanks, the other forming one of the principal sea-gateways in the country, giving access to the ports of Liverpool.

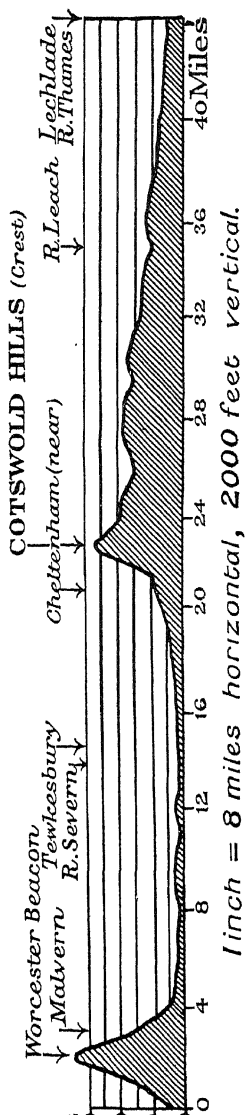


FIG. 7. SECTION ACROSS THE SEVERN VALLEY AND COTSWOLD HILLS.



physical contrast between the two estuaries is notable in this connexion, and they should be compared on a map. The Dee estuary is open-mouthed ; it is entered by the larger river, and tidal currents do not serve sufficiently to scour out the entrance and remove the sand and river sediment. The Mersey estuary has a bottle-neck entrance in which the currents are confined and flow strongly, helping to keep it scoured and deep, although to make it fit for big ships dredging is always needed. The estuaries are separated by

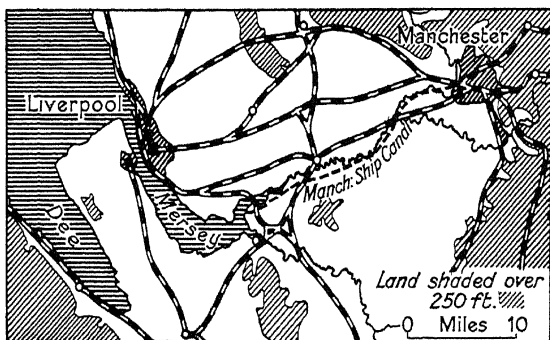


FIG. 8. LIVERPOOL AND MANCHESTER ; mouths of Mersey and Dee ; Manchester Ship Canal. The narrowness of the outlet of the Mersey strengthens the tidal currents through it, which help to keep it clear of shoals, to the benefit of shipping ; in contrast with the outlet of the Dee.

the peninsula of Wirral, a district in which many of those whose work lies in the Mersey seaports, Liverpool and Birkenhead, have their homes.

*The Humber Basin, &c.*—The Midland plateau also connects through the wide valley of the Trent with the lowlands of the Humber basin. The Trent is the principal river which joins the Humber estuary from the south. From the west the rivers Don and Aire, and from the north the Yorkshire Ouse with many tributaries, help to form the same estuary. The lowland of the Humber basin extends northward in the Vale of York between the Pennine highlands on the west and the hills of east Yorkshire—the Yorkshire Wolds of chalk, the North Yorkshire Moors and the Cleveland Hills which mark the end of the limestone belt. The lowland continues north

of these hills into the valley of the Tees, which enters the North Sea through another estuary.

Thus far we have dealt with that part of England which we described at first as lowland. We have now seen that it is crossed by a succession of ranges of hills, and rises to a low plateau in the midlands, but none of these reaches anything like the height of the highlands which we have now to describe. The hills of the south-east hardly ever rise to a height of a thousand feet above sea-level.

*The South-West.*—The first of the highland divisions to be dealt with is that of the south-western promontory of England, the West Country as it is sometimes called, between the Bristol Channel and the English Channel. It includes the counties of Somerset, Devon, and Cornwall, and may be taken as bounded on the east by the Western Downs, and by the limestone Mendip Hills with their famous caves and gorge dissolved out of the limestone by water near the village of Cheddar. The coasts of the West Country are generally steep and high, but are frequently broken by deep, well wooded and beautiful little valleys which often end in inlets of the sea, affording sheltered harbours. The largest port on one of these inlets is Plymouth, with the naval station of Devonport: still further west, Falmouth is a convenient haven of refuge from Atlantic storms. The high open moors such as Dartmoor and Exmoor contrast strongly with the low valleys which separate them. In the valleys are fine pastures, woods and orchards flourishing in the rich, light soils. Dartmoor is a desolate plateau of moorland, its nearly level summits broken by weathered masses of granite which form rough summits known as tors. The moors have their own beauty, but it is very different from that of the richly wooded narrow valleys which lead down from them to the fringe of lowland around. Cornwall and south Devon are noted for their equable oceanic climate, with winters much warmer than elsewhere in Britain. In the sheltered valleys sub-tropical plants are seen which do not flourish anywhere else in England; but the wind-swept moors are treeless. The West Country ends in the granite cliffs of Land's End; but similar rocks appear in the Scilly Islands forty miles out in the ocean, a group exposed to the Atlantic storms, and yet, with its moderate climate, rich in beautiful forms of low trees and shrubs and able to produce spring flowers and vegetables long before they appear in most parts of England.

*The Highlands of Wales.*—The Welsh plateau is bordered by the Cheshire plain in the north-east, the middle valley of the Severn in the east, and the plain of Herefordshire in the south-east. Herefordshire, watered by the river Wye and its tributaries, is a richly wooded county of orchards, enclosed toward the east by the ridge of the Malvern Hills, protected from very heavy rainfall, and warm in summer. The Wye flows through one of the most beautiful valleys in Britain, partly over a narrow alluvial valley floor, partly through gorges between steep well-wooded hills.

On the south the Welsh plateau has a narrow coastal plain ; on the west and the north there is still less lowland between hills and sea. The plateau is deeply cut by valleys, but from any height its general summit level is clearly seen. Some of the chief heights have been mentioned when we discussed the Welsh border. Plynlimmon has been named as the source of the river Severn, as it is also of the Wye. Cader Idris rises above the beautiful Barmouth estuary in the west, and highest and finest of all is the mountain district of Snowdon in the north-west. In this direction the Menai Strait, crossed by road and railway bridges, separates the island of Anglesey from the mainland.

*The Highlands of the Pennines.*—We pass next to the Pennine Hills which extend north from the Peak District of Derbyshire above the Midland plateau nearly to the border line between England and Scotland. The name of the Peak does not imply a sharp-topped hill, for the summit is broad and rounded. Streams flow from these hills through beautiful steep-sided valleys, with the limestone of which this part of the Pennine system is formed standing out here and there in bold cliffs to be compared with those in the gorge of the Mendips at Cheddar. As in the Mendips, too, there are many underground water-courses through the Pennine limestone, and streams sometimes pass underground for several miles and then reappear in the open. There is a complete contrast between the uplands of the Pennines—open moorland with short grass and heather, very thinly inhabited—and the densely populated areas with great manufacturing towns at the foot of the hills and in the valleys of Lancashire and the West Riding of Yorkshire. It may be noted here that Yorkshire, the largest county in England, is divided into three portions, called ridings, the north, the east, and the west.

*The Lake District.*—A strong contrast is seen also between the Pennine Hills and those of the Lake District of north-western England, in the counties of Westmorland and Cumberland and the north of Lancashire. The Lake District is separated from the Pennines, for the most part, by the deep cleft of the Eden valley, a river which flows northward into the Solway Firth. There is, however, an upland connexion between the two highlands, across the Shap Fells. The word ‘fell’, meaning a moorland hill, is connected with the Norse *ffjeld*,<sup>1</sup> just as a common word meaning a waterfall in these parts, namely, ‘force’, is connected with the Norse *fos*. The Lake District, in its way, is the most beautiful part of England. The hills here rise in bold summits, ridges, and crags above wild narrow valleys<sup>2</sup> which radiate from a centre and contain the many lakes which give the district its name. To the south the hills slope toward Morecambe Bay in the district of Furness; to the west they nearly reach the open coast of the Irish Sea; to the north they sink to the lowland around the Solway Firth. To this lowland there opens from the east the passage sometimes called Tyne Gap, which marks the northern end of the Pennines, separating them from the Cheviot Hills on the Scottish Border. The river Tyne flows east through Northumberland to another of those estuaries on the North Sea coast which we shall find presently to be of high importance for British shipping.

*Natural Divisions of Scotland.*—The Cheviot Hills merge northward into the Southern Uplands of Scotland, which are not unlike the Welsh plateau, with high moorlands broken by deep valleys, of which the chief is that of the river Tweed. Long slopes descend northward to the Central Lowland of Scotland which extends between the Firth of Forth on the east and the Firth of Clyde on the west. This lowland, as we shall see, is by far the most populous part of Scotland. It is called a lowland in contrast with the divisions to the south and north of it; but its surface is hilly in several parts. To the north-east a broken line of hills separates it from a series of fertile straths or valleys, of which the largest is Strathmore which drains to the Firth of Tay, as also does the tract

<sup>1</sup> In this word *j* sounds as *y* in ‘yell’, and the final *d* is not sounded. So also with the word *ffjard*, more usually written *fjord* in English use (p. 127, &c.).

<sup>2</sup> Cf. Fig. 2.

called the Carse of Gowrie. The Central Lowland introduces us to the land-form known as a rift valley (Part II, p. 432).

We next reach the highlands of Scotland, a region famous for its natural beauty. Ben Nevis (4,406 feet), is the highest point in Britain, so that these mountains are of no great height, but their outlines are often grand. The glens or valleys between them are sometimes rugged and severe, such as the famous Glencoe, sometimes gentle and wooded, especially toward the south-east as in Killiecrankie. To the south-eastern part of the highlands the name of the Grampian Hills is given. The rivers flow swiftly over rocky beds or open out into beautiful lochs, or lakes, of which there are hundreds among the hills. The formation of many of these lochs by glacial action, to which we have referred already, can easily be seen. The highlands are divided across the middle from the south-west to north-east by the deep valley of Glen More. They slope for the most part more gently eastward than westward, and on the east side long glens drain to the North Sea by the rivers Tay, Dee, Don, Spey, and many more. The eastern valleys are specially noted for their cool, refreshing summer climate, much drier than the wet highlands of the west. Here the highlands break off abruptly along the west coast in bold promontories separated by deep fiords or sea lochs, which resemble those of Norway. The coast is deeply fringed by high islands, the outer chain of which is known as the Outer Hebrides while those near the coast are the Inner Hebrides, of which Skye is the chief. This island contains in the Cuillin (Coolin) Hills some of the finest mountain scenery in Britain. Throughout Scotland from the southern uplands northward there are areas of rock which are known to have been formed in very ancient volcanoes. Sometimes these are hard and stand up in steep crags from lower levels from which the softer rocks surrounding them have been worn away. In some of the western islands, such as Staffa and Iona, volcanic rock, called basalt, is seen, which, having flowed from a volcano in a molten state, has cracked, in cooling, into columns of regular shape. All the rocks of the highlands are very ancient. In the north there are sandstones, which in Caithness form a plateau falling to the sea in sheer cliffs. The Orkney Islands are separated from the north-east of the mainland by the Pentland Firth, a strait full of strong currents between the ocean and the North Sea. These islands again are

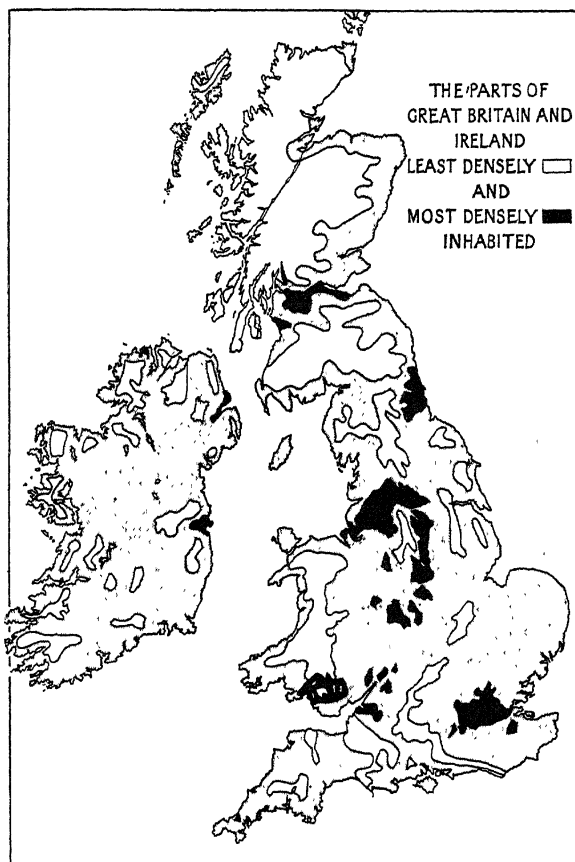


FIG. 9. Some relation can be seen between the least densely inhabited parts (white) and the high lands in Fig. 1 (black). The relation between the most densely inhabited parts and the industrial districts shaded in Fig. 21 is clear.

mostly of sandstone, and in parts high, flat-topped and sheer-sided. They may be contrasted with the Scilly Islands and Land's End, for here in the north there is none of the rich vegetation which is found in the southern group.

*Distribution of Population.*—The divisions in which are found the

chief areas of dense population in Great Britain are these. (1) In the London basin, London and its surroundings. Here, on an area of nearly 700 square miles, there is a population of more than  $7\frac{1}{2}$  millions. (2) On the Midland plateau, from Birmingham and neighbouring towns north-westward for 20 miles. (3) A smaller Midland area, farther north, centring on Stoke-upon-Trent. (4) A curved belt beginning in the Midlands (Leicestershire, Nottinghamshire, east Derbyshire), and extending through some of the southern valleys of the Pennines (West Riding of Yorkshire) westward into south Lancashire and north Cheshire. Some of the high moors of the Pennines, near by the most populous valleys, are almost without population. (5) From south of the Tees, along and behind the Durham and Northumberland coast to north of the Tyne. (6) In Monmouthshire and the southern valleys of the Welsh highlands in Glamorganshire, westward to Swansea. (7) In the Scottish lowlands, where, on one-tenth of the whole area of Scotland, there lives two-thirds of the whole population of the country. Here are some of the largest towns in these divisions : (1) The ' county ' of London has over  $4\frac{1}{2}$  million inhabitants. Of the towns adjoining it, West Ham has 315,000 ; Croydon 194,000. (2) Birmingham (947,000). (3) Stoke (276,000). (4) In the midland part of the belt, Nottingham (270,000), Leicester (240,000) ; in the Yorkshire part Sheffield (525,000), Leeds (470,000), Bradford (299,000) ; in the Lancashire part Liverpool (838,000), Manchester (753,000), Salford (242,000). (5) Newcastle-on-Tyne (284,000). (6) Cardiff (226,000). (7) Glasgow (over a million) ; Edinburgh, the capital of Scotland (428,000). These are seventeen out of the twenty biggest towns in Great Britain. There are about twenty more with populations over 100,000. All these except three are also within our seven most populous divisions. All around the English and Welsh coasts, the east coast of Scotland, and part of the south-west coast there are many large and small towns which are seaports or seaside holiday places (sometimes both). Out of the six towns not included above among the twenty biggest, or among those with populations exceeding 100,000 within our divisions, four are seaports—Bristol (386,000 ; a great manufacturing centre also), Portsmouth (247,000), Plymouth (210,000), and Southampton. One is a seaside holiday place—Brighton. The one town left with a population over 100,000 is Norwich, the chief city in East Anglia. This

should give a general idea of the distribution of the biggest town-populations in the island. They are almost all in the big mining and manufacturing districts, or are coast towns outside those districts. As for other inland towns, there are some industrial towns of importance outside the large manufacturing districts, as we shall find ; and there is a very large number of small towns (from 10 to 20 miles apart over most of rural England) which are centres, or ' market towns ', for local trade. The least populous parts are naturally the mountains and high moorlands, and the largest areas with little or no population are therefore found in the highlands of Scotland.

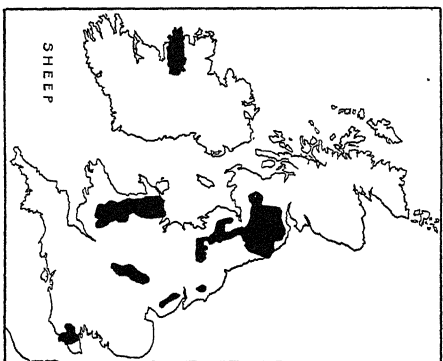
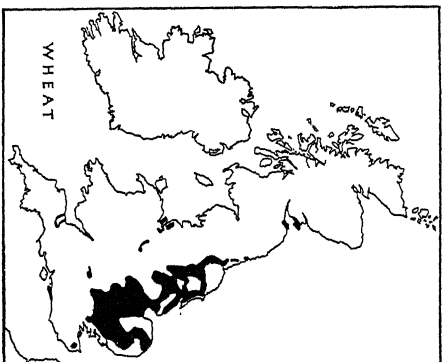
*The Geographical Study of Town-sites.*—The study of geographical conditions which have helped to fix the positions of towns is interesting. The above paragraph suggests some reasons why towns have grown up in certain places—the industrial town, the seaport, the watering-place. Reasons such as these apply, as a rule, to modern conditions. Some industrial towns, it is true, have practised from early times the industries for which they are still famous ; but that they have grown big at those industries in modern times is due to some relatively new condition. In the case of big manufacturing towns in Britain that condition is almost always the nearness of coal for firing machines, &c. ; so that we find often that towns which originally manufactured certain things (woollen goods, for instance, or pottery) because the raw materials could be got close by, continued to manufacture the same things because coal could be got close by, though, as industries grew, raw materials had to be brought from far away. Again, many seaport towns are old ; but their modern importance depends on the fitness of their natural ports (estuaries, or whatever they may be) to admit big modern ships. As for watering-places, a few of those inland are old—the medicinal springs at Bath, for example, were used in Roman times or earlier—but seaside holidays are a modern habit, and towns which have grown as seaside resorts are mainly or wholly new. But in a country like Britain, with a long history, a geographical condition which helped the first growth of a town may have been strengthened or replaced by others later on. There is, for example, a whole set of conditions connected with roads and water-communications (p. 62), which certainly influenced the positions of towns in early times. Of the statements in this paragraph we shall



find examples later, and not only in the British Isles : they are always worth watching for, and, if there is a chance, may be worked out more fully from more detailed books than this, and from large-scale maps.

*Agriculture.*—The density of the agricultural population in Britain is much closer than in lands newly opened up for agriculture, as in Canada, where farmers cultivate very large areas and export the produce (chiefly wheat). On the other hand, it is not nearly so close as the agricultural population in parts of India and China, where it may almost be said that each family grows its own food. In England the principal arable lands (lands on which crops are grown) lie east of a line following the western boundaries of Hampshire, Berkshire, Oxfordshire, Warwickshire, Leicestershire, Nottinghamshire, and the East Riding of Yorkshire. The principal grass (pasture) lands lie west of this line. But there are important arable lands also west and north of this, principally in Staffordshire, Shropshire, and Cheshire, and in the eastern parts of Durham and Northumberland. In Scotland the chief arable lands are mostly in the east, along the coastal strip and the straths or lower valleys of the rivers flowing to the North Sea. The main line of 30 inches of mean annual rainfall on the map (Fig. 5), is seen to mark off this area fairly nearly, so we may say that the principal arable lands are in those parts of Great Britain which have on an average less than 30 inches of rainfall in the year. When the rainfall is spread over the whole year, as it is in the British Isles, the chief grain crops (wheat, barley, and oats, and especially the two first) may suffer from too much rain, especially if much rain falls in late autumn and early spring when the land is being prepared for sowing the grain, or in summer when the crops should be ripening for harvest. In the west of England it is usually the preparation for sowing which is made difficult by too much rain, and only the lighter soils which drain more easily are arable. In Scotland the danger of a late and wet harvest time is the greater.

In England, then, the chief wheat-growing counties are Essex, Hertfordshire, Bedfordshire, Huntingdonshire, and Cambridgeshire, and for barley Suffolk, Norfolk, and the East Riding of Yorkshire. There are specially rich grain lands on the coastal belt under the South Downs in Sussex (which appears as a separate strip of land



FIGS. 10, 11, 12. The *chief* districts in Great Britain and Ireland for wheat (10), sheep (11), and cattle (12), marked in black.

in the yearly rainfall under 30 inches), and in the Fen country, south Lincolnshire, the flat alluvial districts about the lower Trent and the Humber, and the vales of York and Pickering, all within the main 'dry' belt. Rainfall, however, is not the only geographical factor affecting the distribution of wheat. The annual range of temperature and the amount of sunshine, both of which we found (p. 12) to be larger in the east of England than in other parts, are important; for warmth and sunshine ripen the crops in summer, and frost in winter helps to break up the soil for cultivation. Again, the clay soils are good for wheat, and the level country of East Anglia (as an example) makes it easy for farmers to transport their crops. It may be added that the field crops of East Anglia are unusually varied; they include mustard (largely manufactured at Norwich) and sugar-beet for the supply of sugar factories established in recent years.

The lands bordering the Downs in Kent are specially famous for fruit and hops; rich clays on the surface, with lighter soils beneath, are good for these, and the importance of sunshine and warmth is to be noticed again. The oast-houses in which the hops are dried—round buildings with conical roofs and high cowl—help to give Kentish rural scenery a character of its own. Other well-known fruit districts are in and on the borders of the Fens, in the sheltered Vale of Evesham, and in Worcestershire, Herefordshire, Gloucestershire, and Somerset, where apples are grown largely for making cider. Hops appear again in Herefordshire. Apples, pears, and plums are not grown for trade in great quantity north of the Midlands. Market-gardening (vegetable-growing) is carried on chiefly near large towns, where the produce is needed and the distance to carry it is short; thus there is much market-gardening on the alluvial lands in the Thames basin near London, and in Surrey, Kent, Hertfordshire, and Bedfordshire, and also in the Vale of Evesham for Birmingham, &c., and in south Lancashire and Cheshire for the big towns there. An example of the importance of temperature is found in the supply of early potatoes. As frosts in spring are rare in the Channel Islands and Cornwall, the earliest supplies of potatoes come from there to London and other markets.

*Cattle and Sheep.*—The clay valleys and neighbouring lands from Dorsetshire northward to the Trent have large extents of rich grass-

land. For rich pasture a good rainfall, moist air, and a distribution of rain over the whole year are favourable—conditions different from those which best suit the cultivation of grain crops. Dorset, Somerset, and Devon are noted for cattle and dairying industries; the north-west Midlands also, which supply much milk to the big towns thereabout, while both Cheddar in Somerset, and Cheshire, give their names to cheeses which are now made in many lands. The Solway plain again, fertile, but rather wet for cultivation, pastures many cattle. Cattle are fed also on clay grass-lands in southern Essex and Hertfordshire, for part of the milk-supply of London; but the London milk-trains are most numerous on the western railways. The density of the sheep population, so to say, is probably closer in England, Wales, and the southern uplands of Scotland than anywhere else in the world; great sheep-farming countries like Australia have larger numbers, but on a much larger area. In hilly districts, cattle are often found in the lower valleys, sheep on the upland pastures, as in the Pennine country and the Lake District. Sheep are numerous on the chalk uplands of the Downs, the Chilterns, and the Yorkshire Wolds, and also on the Cotswolds; for dry land is healthier for their feet than wet. The flat seaside grass-lands of the south-east, such as Romney Marsh, are noted for them. Many sheep are reared on the Welsh highlands, and Welsh mutton is famous.

In the south-west of Scotland, below the uplands, and bordering the sea, there is a good agricultural district, where dairy-farming is also important. We have noticed already the agriculture of the east coast lands. One of the best districts is that south of the Firth of Forth, with barley, oats, and potatoes among the chief crops; another is in Strathmore and the Carse of Gowrie, where the cultivation of small fruit (raspberries, &c.) is to be noted. The lowlands of Aberdeenshire and the Spey, Dee, and Don valleys, are well farmed, and cattle (for beef) are important. Oats and potatoes are specially valuable crops on low-lying lands around Moray Firth and in eastern Caithness.

*Fisheries.*—The shallow seas around Britain and north-western Europe are very rich in fish: we may compare the fishing 'banks' across the Atlantic, off Newfoundland and eastern North America (p. 315). British fishermen go far, and work not only in the North

Sea, English Channel, Bristol Channel, and Irish Sea (cf. p. 69), but also west and north of Scotland, off the Faeroe Islands and Iceland, and as far as the White Sea northward, and in the waters off France, Spain, Portugal, and Morocco southward. Of the principal fish, herring, haddock, ling, halibut, cod, and plaice come mainly from the North Sea and northern fishing grounds; mackerel, sole, and pilchard (for which Cornish fisheries are noted) from southern waters. The principal fishing ports are Grimsby, Hull, London, Lowestoft, Yarmouth (all east coast ports), Fleetwood (Lancashire) and Milford (South Wales), and Aberdeen in Scotland; on all coasts there are many other ports from which fishing is carried on, but the big fishing industries concentrate upon a few ports so that the fish may be landed and distributed in bulk by railways to inland towns, as well as to other coast towns, less easily reached by boats from the fishing waters.

*Coal and Iron Mining.*—Of all the minerals raised in Great Britain, coal represents nine-tenths of the value. The coal-fields are: (1) the Scottish; (2) the northern group in Northumberland, Durham, and Cumberland; (3) the Yorkshire (West Riding) field east of the Pennines, extending into Derbyshire and Nottinghamshire; (4) that of Lancashire west of the Pennines, with smaller fields in Cheshire and North Wales; (5) the Midland group in Shropshire Staffordshire, Warwickshire, Worcestershire, and Leicestershire; (6) the South Wales field (extending into Monmouthshire). There are small fields in the Forest of Dean, near Bristol and in Somerset, and in the east of Kent, this last having been worked only recently in comparison with the rest. An idea of the relative importance of the fields is given by the percentage of people employed in them to the total number of miners: the Scottish fields employ about 11 per cent., the Northern nearly 21, the Yorkshire-Lancashire group 39 (Yorkshire alone 17), the Midland fields 8, the South Wales field 20, and the Forest of Dean, Bristol, and Kent fields together little more than one per cent. The value of British coal to British manufacture is increased by the fact that there is no large amount of water-power to be got from the rivers. The biggest rivers are slow-flowing, unlike the rivers in such lands as Scandinavia, Switzerland, and North America, where there are strong rapids and falls to be used to drive machinery. Water-power is used in the highlands of Scotland (for

example) in aluminium works. A plan has been made for using the power of the high, swift tides in the estuary of the Severn (p. 64).

It is an important point that several of the coal-fields border the coast (there are mines where miners work under the sea). The

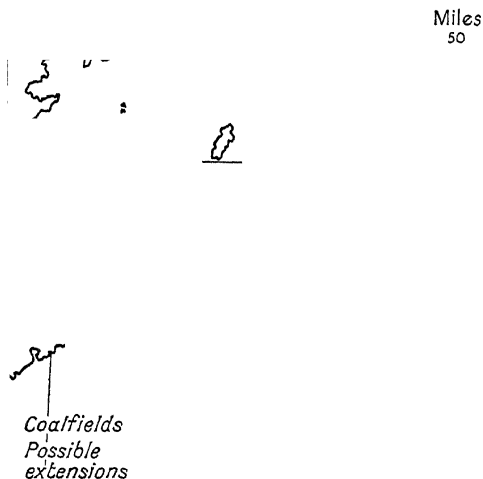


FIG. 13. CHIEF COALFIELDS IN GREAT BRITAIN: (1) Central Scotland. (2) Northern, (a) Northumberland, (b) Durham, (c) Cumberland. (3), (a) Yorkshire W.R., (b) Derbyshire, (c) Nottinghamshire. (4), (a) Lancashire, (b) Cheshire, (c) North Wales. (5), (a) Shropshire-Worcestershire, (b) Staffordshire-Warwickshire, (c) Leicestershire. (6) South Wales. (7) Forest of Dean. (8) Bristol-Somerset. (9) Kent.

Scottish fields are in or near the lowlands, close to the ports of the Firth of Forth in the east, and to Glasgow and other ports in the west. The Northumberland-Durham field has its outlet in the river Tyne. The Cumberland field has ports at intervals along the coast (Whitehaven, Workington, Maryport), none very large: there is no large inlet here upon which sea traffic would naturally concentrate, as upon the Tyne. The South Wales field is in the highland close

behind the ports of Cardiff, Swansea, and Newport. From such fields coal can be exported by sea very easily, and the export of coal is of immense importance to British trade. But whether any particular coal-field exports much or little, it is the position of the coal-fields which has in great part fixed the position of great manufacturing industries. These were, and to some extent still are, helped also by the existence of iron ore close to many of the coal-fields. Iron is found near coal in Scotland, in the Furness district of north Lancashire, in the Cleveland district of the North Riding of Yorkshire (near the port of Middlesbrough and the Durham coal-field), in Lincolnshire south of the Humber estuary, at several points in the Midlands, and in South Wales. Iron is still the British mineral next in value to coal, though the value is scarcely an eightieth part of that of coal; and for the big industries using iron, ore is imported. It comes, for example, from Sweden to Middlesbrough, and from Spain to South Wales (Merthyr Tydfil and other places). Other iron-smelting centres are in the Clyde and Forth districts of Scotland, at Barrow-in-Furness, in north Lincolnshire, the West Riding of Yorkshire, and the Black Country in the Midlands.

*Manufactures in Metal.*—Manufactures using iron and steel are widely distributed in Great Britain. We have seen that the principal manufacturing districts are on or near the coal-fields, but it should be remembered that there are important manufactures in many towns not near coal-fields; and also that some manufactures for which particular towns near coal-fields are noted, were started in those towns long before the coal-fields were used. As for manufactures not near coal-fields, there are plenty in and around London, principally to the east, in the neighbourhood of the docks on the lower Thames. There has been a tendency in recent years for big manufactures to arise in places distant from the coalfields: the use of electricity for power and oil for fuel is among the reasons for this movement. In eastern England, as it is the division containing the greatest extent of arable land, the making of agricultural machinery is carried on, in such towns as Lincoln, Grantham, and Norwich. As for the early establishment of industries, before the coal-fields were developed, Birmingham and Sheffield give good examples. Three hundred years ago men were working iron in Birmingham. It was found near by, and the forests gave fuel for smelting it. So iron-working trades

had been long established there when the coal-fields in the neighbouring Midlands came into use. Then Birmingham became the chief of a number of metal-working towns, which extend to the north-west through the Black Country—an ill name, deserved from the appearance which industry has given it—and also to the east and south. Not only iron and steel, but also brass, bronze, and other metal goods are made, and of all sorts from heavy machinery, engines, and motor-cars to pins and needles. Many kinds of small metal wares are made. The name of 'brummagem' sometimes given to cheap metal ornaments and the like came from an old local form of the name of Birmingham, and was applied to imitations of more valuable articles (even of coins) for which the town once had a reputation. Sheffield in the west riding of Yorkshire is famous for the manufacture of cutlery (knives, edge-tools, &c.) now, and so it was at least four hundred years ago and probably much longer. Here, too, iron was at hand, with wood for fuel, good stone for grindstones in this part of the Pennines, streams to turn them, and exposed hill-sides where the winds helped to blow up the smelting fires. Besides cutlery and tools, Sheffield now makes heavy steel goods such as armour plate.

The heaviest steel and iron goods are naturally made where smelting is carried on; examples are the steel rails made at Middlesbrough and Barrow-in-Furness, and the tin-plating industry carried on in South Wales (Swansea, Llanelly, Cardiff, &c.). From such places heavy goods can be directly exported by sea. For steam-engines there are big works, in addition to those of the Birmingham district, at Manchester, Darlington, Newcastle, Glasgow, and many other places. The making of machinery used in the cotton manufacture of south Lancashire is naturally carried on there, and that of machinery for the woollen manufacture in the West Riding of Yorkshire. The great railways have their own engineering works in towns which, sometimes, have been created for this very purpose; the Southern Railway works at Eastleigh near Southampton, the G.W. works at Swindon, and the L.M.S. works at Crewe, are examples. Other big railway works are, for the L.M.S., at Derby, and for the L.N.E. at Doncaster. For ship-building, the Clyde (Glasgow and neighbouring towns) is the chief centre; the Tyne ports (Newcastle, &c.), and Barrow-in-Furness are other examples;



and here should be remembered the naval dockyards at Portsmouth on Spithead, at Devonport (Plymouth), and at Chatham and Sheerness where the Medway estuary joins that of the Thames. Motor engines and cars are made at many places besides Birmingham, and Coventry in the same neighbourhood. In (or near) London, Oxford, Manchester, and Glasgow there are large works.

*Other Minerals and Stone.*—Lead, tin, and copper are found in Great Britain, but the amount raised is very small. Tin and copper used to be mined largely in Cornwall ; a few mines still work, among many of which the disused buildings and rock-heaps give the upland country a strange, desolate appearance. Lead is found in Derbyshire, Durham, &c. In Cheshire salt is largely evaporated from brine, and found also as rock-salt. In some of the salt-mining towns houses are seen standing lop-sided, where the ground has sunk owing to the salt-workings beneath the surface. Mineral oil is not found in large quantity, though a little has been found in Derbyshire ; but in some parts rocks called oil-shales, from the fact that oil can be extracted from them, yield a supply of some importance : the district where they are chiefly worked lies north and south of the Firth of Forth in Scotland.

Great Britain, we have found, consists of many different kinds of rocks, and many of these are good building stones ; we should notice the famous Portland stone, named after the isle of Portland on the south coast ; the granite of Devon and Cornwall, the Charnwood Forest district of Leicestershire, and the country near Aberdeen ; and the slates of Devon and Cornwall, North Wales, and the Lake District. There are big cement works in the Medway valley in Kent, where the river cuts through the chalk hills of the North Downs.

*Textile Manufactures.*—The textile industries (those concerned with cotton, woollens, and silk) are of first-rate importance in Great Britain. In England the cotton manufacture belongs almost wholly to south Lancashire, though it extends to a few towns in the adjoining counties. Among geographical reasons for its position in Lancashire, in addition to the presence of coal, are these. The ‘ soft ’ water from the streams of the Pennine grits is valuable in connexion with bleaching and dyeing the cotton, and is specially good for use in steam-engines because it does not form deposits in tubes and boilers. The streams are maintained by a high rainfall all the year, which also

ensures a moist air. This prevents the cotton yarns from becoming brittle and makes them easier to spin (though by itself it would not have been a sufficient geographical reason for fixing the industry in this particular part of England ; moreover, the air in cotton-factories can be made moist artificially). Bleaching and dyeing need the use of chemicals, and the chemical industry of South Lancashire is connected with the presence of salt deposits in Cheshire, for it uses salt largely. And the ports (especially Liverpool, and more lately Manchester) are best situated for trade with North America, from which the supply of raw cotton comes in large proportion. Scotland has a cotton industry in Glasgow, Paisley, and the neighbourhood—in the west, that is, of the industrial lowland, and with a western port in Glasgow.

Manchester is the centre of the Lancashire cotton trade, though not of the manufacture, which is carried on in many neighbouring towns, such as Oldham, Bolton, Bury, Rochdale, and Preston. Manchester was an important trading centre long before the existence of the cotton industry as we have it now. The Pennine slopes half encircle the basin in which it stands ; and its site can be seen on a contoured map as one toward which routes from a number of the Pennine valleys naturally converge, while it has free communication with the plains, south, west, and north, and with the Mersey estuary.

The woollen industry belongs chiefly to the West Riding of Yorkshire. This is an industry long established here, for sheep-pasture was plentiful on the Pennines. It flourished also in other parts where the same condition was found, as for instance in towns on the slopes of the Cotswold Hills, and in Norfolk. But later, the presence and use of coal in Yorkshire strengthened the industry there, and the absence of coal caused it to decline in other districts. It is still carried on in the Stroud valley of the Cotswolds in Gloucestershire, but on no such big scale as in Yorkshire. The chief centre of the Yorkshire trade is Leeds, the position of which as a trading centre may be compared with that of Manchester, though it stands within the Pennine hill-region. The Aire valley, however, in which it is situated, soon opens to the plain east, south, and north, and leads westward to three of the easiest routes through the hills. Leeds makes both cloth and clothing (and also has big engineering works). Of the many towns in the industrial valleys of this district some are

specially noted for particular woollen products—Bradford for worsted, velvet, and plush ; Saltaire, near by, for alpaca ; Halifax for light cloth and for carpets ; Dewsbury for heavy fabrics ; Huddersfield for ‘ fancy ’ goods, and so on.

In Scotland woollen industries flourish in towns in the basin of the Tweed, among the southern uplands—where, again, the extent of sheep-pasture is large : it is also found in many of the lowland towns. Tweed is the name of the best-known sorts of woollen cloth. Cloth-making, not in factories but in the cottages of country-people,

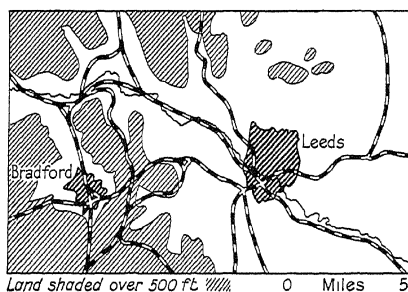


FIG. 14. THE POSITION OF LEEDS on the edge of the Pennine hill-country and the Yorkshire plain, and of BRADFORD within the hill-country.

is of some importance elsewhere in Scotland, notably in the islands of the Outer Hebrides and the Shetlands ; we may compare a similar industry in the west of Ireland (p. 69).

Manufactures of hosiery and lace are characteristic of Leicester, Nottingham, and the neighbourhood. That of artificial silk is carried on in Wolverhampton and elsewhere in the Midlands, including Derbyshire. That of silk goods is carried on in Cheshire (Congleton, Macclesfield, &c.), and this manufacture, again is repeated in the Scottish lowlands (Glasgow, Paisley, &c.). Perth is specially noted for a dyeing industry, and Dunfermline for linen. Dundee makes jute goods and coarse fabrics.

*Other Manufactures.*—The making of pottery and china has been long established at Stoke-upon-Trent. The district of which this town is the centre is commonly called the Potteries. Here clays for the manufacture were found abundantly, and coal for the firing is

near. The use of salt in glazing pottery was early discovered ; and we have seen that salt is produced near by, in Cheshire. Kaolin or china clay is formed by a natural process from the granite of Cornwall and Devon, is mined there, and is shipped thence for the factories at Stoke. Among other industries for which particular places in England are noted are the glass-making of St. Helens in south Lancashire, which needs a large supply of local coal ; the chemical works in the same district, connected with the Cheshire salt district, already noticed ; the boot-making in Wellingborough, Northampton, and neighbouring towns in a district which is noted for cattle, and used to supply this industry with all the leather it needed ; the chair-making of the Wycombe valley in the Chiltern Hills, where beech-woods flourish and long ago yielded wood for this industry ; and the biscuit-making in Reading. One of the best of exercises for those who study economic geography is to find whether there are strong geographical reasons why any particular industry (in the home-town, for example) was established, and is carried on, where it is.

*Regional Distribution of Industries.*—Let us now summarize in relation to the natural divisions of Great Britain points in the geography of agriculture, mining, and manufactures which we have been considering. The following is an outline of the picture ; there is opportunity for exercise in filling in the details.

*London Basin.*—Agriculture—market gardening around London in alluvial lands near Thames, and in Bedfordshire. Cattle for milk supply, Essex and Hertfordshire. Barley and other grain crops in East Anglia ; fruit on northern slopes of North Downs (towards east). Chief manufacturing area, east of London and along Thames estuary ; isolated industrial towns, e.g. Reading (biscuits), Norwich (agricultural machinery, manufactures connected with agricultural products, such as mustard).

*The Weald and the Chalk belts.*—Rich agricultural lands in the Weald of Kent and Sussex. Kent specially noted for hops and fruit ; fine grain lands south of South Downs in Sussex. Sheep on chalk Downs and more northern chalk hills to Yorkshire Wolds, also on seaside grass-flats. Coal-field developing in east Kent. Isolated manufacturing towns and districts.

*Hampshire Basin.*—In some respects similar to London Basin (rocks and soil, agriculture, &c.). Chief industrial centres, Southampton and

Portsmouth ; marine and other industries connected with these ports (ship-repairing and building ; yachts, boats, hydroplanes, &c.). East-leigh railway works.

*Clay valleys.*—Rich grass-lands : cattle. Isolated industrial towns, e.g. Swindon and (in part) Oxford.

*The Fens and neighbouring lowlands.*—Include some of the chief wheat districts in England. Small fruit in the Fen district. Manufactures locally, e.g. agricultural machinery (Lincoln, &c.) ; jams (Cambridge, Wisbech).

*Limestone Belt.*—Sheep on hill pastures ; cloth industry locally (Stroud valley). Building stones (Portland, Bath). Boot manufacture, Northampton and neighbourhood. Cleveland (north of belt) iron-field, near Middlesbrough.

*Midlands.*—Agricultural districts of special note are the Vale of Evesham (fruit, market-gardening) ; the northward extension of the lowland in the Vale of York, &c. (barley and wheat). Cattle and dairy-farming. Coal-fields. Manufacturing districts (Birmingham, neighbouring towns, and Black Country ; Leicester and Nottingham ; the Potteries).

*The South-west.*—Arable lands on lighter soils. Fruit (apples) in Somerset, &c. Cattle and dairy-farming. Plymouth and Devonport as chief industrial centre. China-clay, slate, granite ; former wealth in tin and copper (Cornwall, Devon).

*Wales.*—Highlands noted for sheep-farming. Bordered in south-east by Herefordshire district—fruit, hops. Coal-field, with iron and accompanying manufactures, tinplates, &c., in south ; smaller coal-field in north-east ; slate in north-west.

*The Pennines and their borders, and the Lake District.*—Sheep-farming on uplands. Coal-fields in valleys and borders east (Yorkshire, &c., Durham and Northumberland) and west (Lancashire, &c., Cumberland). Salt in Cheshire. Great manufactures : woollen, steel, engineering, cutlery (Yorkshire), cotton, glass, chemicals (Lancashire), ship-building (Tyne), &c. Iron in Furness district ; slate in Lake District.

*The Border and Southern Uplands of Scotland.* Sheep on upland pastures. Woollen industry in Tweed basin. Agriculture and dairy-farming on coastal slopes west and south-west.

*Scottish lowland and bordering hills.*—Agriculture of high standard especially in east and extension of lowlands north-eastward ; barley, oats, small fruits ; cattle. Coal-fields, iron, and principal Scottish manufacturing division.

*Scottish highlands.*—Sparsely populated ; agriculture and industries

limited and local. Granite quarrying in east (Aberdeen). Home weaving industry (western islands). Water-power (aluminium works, Kinlochleven, &c.).

*Commerce.*—The special geographical advantages which Britain enjoys as a commercial country are these. (1) Its position, with direct sea communications to Europe on the one hand, North America on the other : it holds a more nearly central position in the world's chief industrial region than any other country. (2) A climate which does not, at any season, greatly delay industry or communications : harbours are never blocked by ice nor railways by snow for any long time ; there is no hot season when men cannot work hard. (3) Abundance of coal. (4) Good seaports on all coasts. (5) Easy communications inland. The industrial districts have easy access to both east and west coasts ; so that, for example, Lancashire may import raw cotton mostly at west coast ports, but export cotton goods from east coast ports for markets in Europe.

We should notice a few points about British trade bearing in a general way upon what we have learnt of British agriculture, mineral wealth, and manufacture. Imports into Britain are of greater value than exports of Britain's produce, on an average, as 8 : 5. Something less than half the total value is represented by food, drink, and tobacco ; something less than a quarter by manufactured goods, and the rest by raw materials for the manufactures. On the other hand, of the total value of exports, manufactured goods represent over three-quarters. Of raw materials exported, the group which comes next, nearly three-quarters of the value is, normally, that of coal. Of the total value of imports, seven-tenths represents those from foreign countries, and three-tenths those from countries of the empire. Of the total value of exports, less than six-tenths represents those to foreign countries, and more than four-tenths those to countries of the empire. The proportions from and to countries of the empire should grow. Of the countries from which Britain receives most imports (by value) the United States of America stands easily first ; the value of imports thence is not much less than one-fifth of the whole, including wheat and other foods, cotton, and many kinds of manufactured articles. Then follow India (wheat, cotton, &c.) and Argentina (wheat, meat, wool) ; Canada (wheat, &c.) and France (wines and a large variety of goods) ; Australia (wheat, meat, wool) ;

the Irish Free State (dairy produce, &c.) ; New Zealand (meat) and Denmark (dairy produce) ; Holland (various goods), Egypt (cotton, &c.), Belgium and Germany (various manufactures), and Sweden (iron, timber, paper). Here is illustrated the high place taken by the food imports : the principal countries sending wheat are Canada, the United States, Argentina, Australia, and India. Among the articles mentioned as illustrating characteristic exports from these countries we notice also the importance to British manufactures of the countries sending raw cotton and wool. But many other examples might be taken : for instance, among the food imports, sugar, tea, coffee, cocoa, and fruits ; and among the raw materials the metals, timbers, oils, hides, rubber, and other materials for industry, of which Britain itself produces only a small proportion of the amount needed, or none at all. Throughout this book examples will be found of the countries which yield the chief supplies of such materials. British exports are sent chiefly to India, Australia, the United States, the Irish Free State, France and Germany, South Africa and Argentina, Holland, New Zealand, and Belgium. The manufactured goods exported fall chiefly into the groups of cottons, woollens, clothes, iron, steel and other metal manufactures, machinery of many kinds, ships and vehicles, and chemicals.

*Shipping and Ports.*—London owes its position, both as the chief port of the British Isles and the capital city, in the first place to its situation at the head of the Thames estuary, with easy access across the North Sea to the mouths of the Schelde, Rhine, and Elbe, and to the Baltic. Big ships up to 15,000 tons sail up the estuary nearly to the Tower Bridge, but still larger ships berth at the outport of Tilbury on the north shore. Imports into London largely exceed exports in value because London is rather a general market and distributing centre than the outlet for a large manufacturing or mining district, as Liverpool, Hull, and other ports are. Of other leading ports, Southampton, like London, is not a centre for an industrial district, but it is the principal passenger port for North America, South Africa, &c., having one of the best natural harbours in the world. The water is kept deep by high tides<sup>1</sup> for an unusually long time, because the tidal wave, passing up the English Channel, enters Southampton Water first by the strait of the Solent, west of the

<sup>1</sup> On tides see Part II, p. 500.

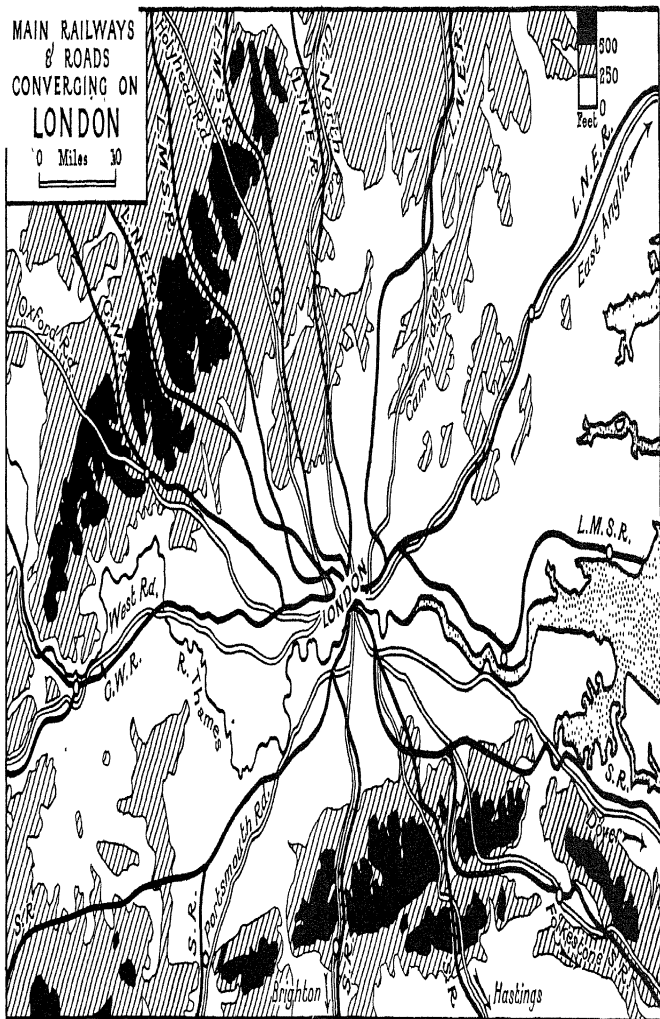


FIG. 15. LONDON: ITS POSITION, MAIN RAILWAYS, AND MAIN ROADS. The small circles represent important towns; they may be named from an atlas and their positions studied in relation to the passage of railways and roads through the hills, or to the river Thames.



## The British Isles

Isle of Wight, and later again by that of Spithead, east of the island. Liverpool and Birkenhead face each other across the estuary of the Mersey, the gateway to the Lancashire industrial district; Liverpool, on the Lancashire side, is therefore the greater port. Its overseas trade, world-wide, is most of all important in connexion with North

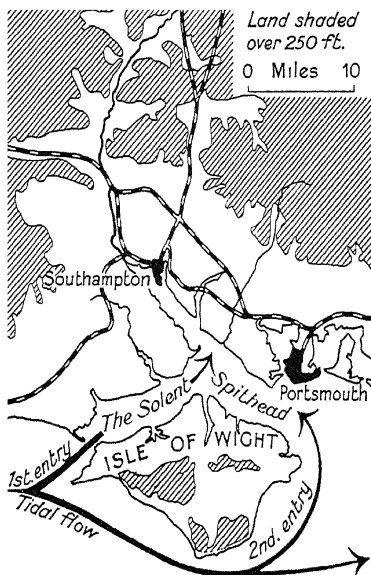


FIG. 16. SOUTHAMPTON AND ITS TIDES.

America. Hull, on the Humber estuary, is most closely related to the Pennine industrial district in the West Riding of Yorkshire; the estuary faces toward north-western Europe, and a large trade with North Sea and Baltic ports converges upon it. Bristol is an example of a port which in comparison with others used to be more important than it is now, for the river Avon in its gorge is not big enough for large steamers to sail up it; but Bristol has outports at Avonmouth and Portishead at the river-mouth in the Bristol Channel, and the overseas trade is still large, notably with the West Indies and

Central America. Cardiff is connected with the South Wales coal-field ; Newcastle-on-Tyne with that of Northumberland. Glasgow is the first Scottish port, on the estuary of the Clyde, the western seaway to and from the industrial district of the Scottish lowland. A big ship-building industry is established here. Leith (the seaport portion of Edinburgh) is the chief eastern port for the same district, on the Firth of Forth. Dundee and Aberdeen are other leading ports

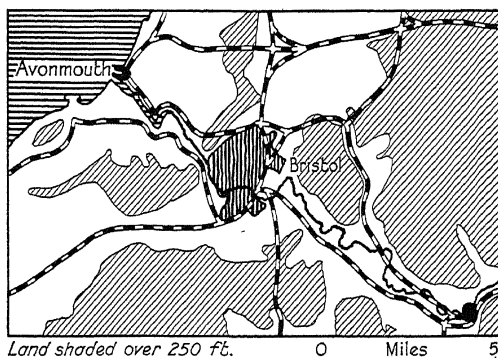


FIG. 17. BRISTOL AND ITS OUTPORT AT AVONMOUTH.

of eastern Scotland. Ports of less but still great importance may, in most cases, be grouped with ports already named : thus, North and South Shields, Blyth, and Sunderland with Newcastle on the Tyne estuary, and Middlesbrough on the Tees estuary ; Grimsby, Immingham, and Goole with Hull on the Humber ; Newport and Swansea with Cardiff serving the industrial districts of South Wales. Harwich in Essex has a large trade with Denmark, Holland, and Belgium. And last, but of leading importance and geographical interest, Manchester, connected by ship-canal with the Mersey, has thereby become a seaport for trade which must otherwise have been dealt with at Liverpool. (Fig. 8.)

The principal connexions with Europe for passenger steamers are the following :

Dover to Calais (France), the shortest sea-route (21 miles), across the Straits of Dover, to Boulogne (France), and to Ostend (Belgium).

Folkestone to Boulogne, and to Flushing (Holland).

Newhaven to Dieppe (France).

Southampton to Havre and other French ports.

All these are connected with the Southern Railway.

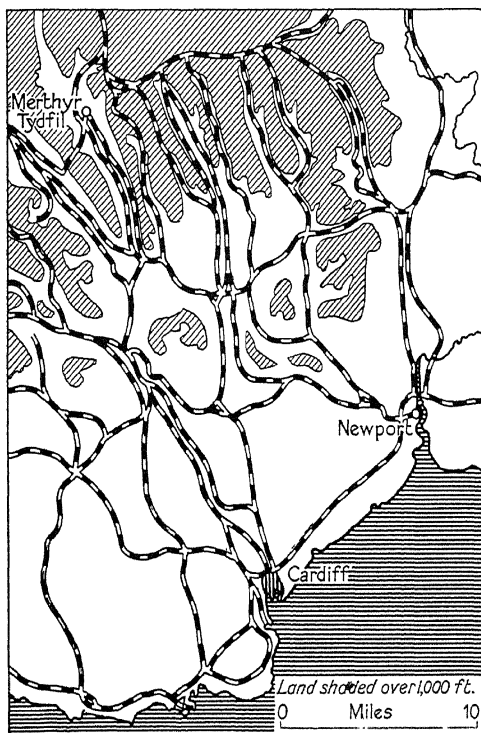


FIG. 18. The railways leading from the South Wales coalfield in the valleys behind the coastal lowland, to the ports of Cardiff and Newport.

Eastward, we have various services from the Thames (London, Gravesend, and Tilbury), and the L.N.E.R. services from Harwich to the Hook of Holland and to Antwerp (Belgium), and from Grimsby to Hamburg.

In addition to the connexions between Hull and northern Europe, Newcastle is a centre for traffic with Norway.

The routes to Ireland are mentioned on p. 70.

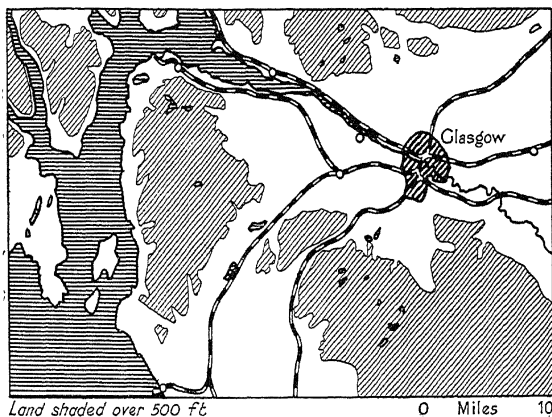


FIG. 19. GLASGOW AND NEIGHBOURING TOWNS ON THE CLYDE AND ITS FIRTH.

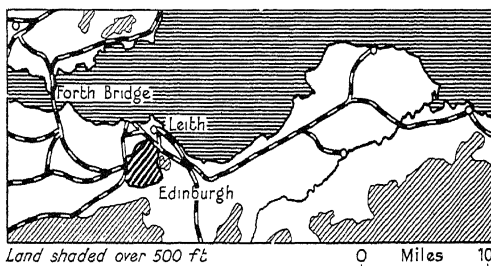


FIG. 20. EDINBURGH AND THE FORTH BRIDGE.

The chief port for aeroplane services to Paris, Brussels, and other European air-ports is situated near Croydon on high open ground on the southern outskirts of London. Cardington, near Bedford, promises to become an airship port of imperial importance, well situated for communication by land not only with London but with the populous midland and northern districts.

*Railways.*—All but a small proportion of the railways of Great

Britain are divided between four great companies, the Southern, the Great Western, the London, Midland, and Scottish, and the London and North Eastern. We will briefly trace some of their main routes : it is a good exercise to do this in fuller detail, and to work out other routes. We will first consider main lines from London, and a few of their branches.

The Southern Railway serves the south of England from Kent to Cornwall, and it controls the connexions with the steamer routes across the English Channel between England and the Continent (p. 51). The chief point of geographical interest about the lines south-east and south from London is their passages through the North and South Downs. In both we find the river-gaps (p. 22) followed by railways—the Medway, Darent, and Mole (Dorking) gaps through the North Downs ; those of the Ouse, Adur, and Arun through the South Downs. Lines which do not follow these gaps find steep slopes and need tunnels : examples are the direct line from London through Sevenoaks to Tonbridge, the main line to Brighton, and the line through Guildford to Portsmouth. The river Wey makes a gap in the North Downs at Guildford, but in part it is narrow and the town stands in it, so that the railway must here tunnel the hill to one side. East-and-west communications through the Weald are easy : we may notice the unusually straight line between Folkestone, Tonbridge, and Redhill. The main line to the south-west crosses the Thames basin from London, and rises high between the Hampshire Downs and Salisbury Plain. It sends off a branch to Southampton, Bournemouth, and Weymouth, and itself continues by a hilly route, mainly over the northern slopes of the Western Downs, to Exeter. Thence to Plymouth it runs round the north and west sides of Dartmoor.

The direct south-western line of the Great Western Railway runs from London up the Thames valley to Reading, thence up the tributary valley of the Kennet, and so by an easy crossing of the edges of the basins of the Hampshire and Bristol Avons, eastward of the Mendip Hills and into the plain of Somerset. From Taunton it follows a wide passage between the Blackdown Hills and the Exmoor region, and reaches Exeter. Thence its course is east and south of Dartmoor—partly close along the beautiful coast—to Plymouth. It crosses the Tamar estuary by a big bridge at Saltash, and follows



a hilly track high over the valleys which lead down from the central upland of Cornwall, until it reaches Penzance on the south Cornish coast, not far from Land's End. The western main line continues from Reading up the Thames valley through Goring gap (p. 20), and runs along the Vale of the White Horse, through Swindon, and into the Bristol Avon valley, which it follows (though not without tunnelling) to Bath and Bristol. Formerly all traffic for the south-west of England and for South Wales came this way, but the Kennet valley route was opened up as more direct to the south-west, and a direct line to South Wales was made from near Swindon, tunnelling the Cotswold Hills and avoiding Bath and Bristol. The South Wales line goes under the Severn estuary in a tunnel  $4\frac{1}{2}$  miles long, and follows the narrow lowland at the foot of the Welsh highlands, bordering the Bristol Channel, through Newport, Cardiff, and Swansea, across the neck of the Gower Peninsula, and so to the south-western ports of Milford Haven and Fishguard.

Near the point where the western line enters the Vale of White Horse another main line strikes north up the Thames valley to Oxford, the centre of the upper Thames basin. Thence it continues north up the tributary valley of the Cherwell, passing Banbury. Near this town a more direct line joins from London; it passes through the Chiltern Hills by an easy depression about High Wycombe and Princes Risborough, and for a short distance is on the very low divide between the basins of the Thames (Cherwell valley) and the Great Ouse. The line from Banbury passes easily between Edge Hill and the Northampton uplands, crosses the Vale of Evesham, and reaches Birmingham. Thence it runs north-west through the manufacturing district of the Black Country, and follows the Midland passage on its west side, reaching the river Severn at Shrewsbury. It continues north over the Cheshire plain to Chester, and thence to Birkenhead on the Wirral Peninsula shore of the Mersey, opposite Liverpool. From this line there are branches across the Welsh Highlands to the west coast: (a) from Shrewsbury (or Whitchurch) to Welshpool up the Severn valley, and by a pass through the highlands into the valley of the Dovey (Dyfi); (b) from Ruabon up the valley of the Dee, and across to the Barmouth estuary. These join a line running along or near the Welsh coast from south to north.

The London, Midland, and Scottish railway system includes the

so-called West Coast route between London and Scotland. From London it passes through the Chiltern Hills by an easy gap near Tring, and crosses the clay country and the Northampton uplands to Rugby (branch to Birmingham, &c.). Then making for the upper Trent it passes through the Midland gap near Stafford and reaches Crewe in the Cheshire plain. This is a big junction and a centre for

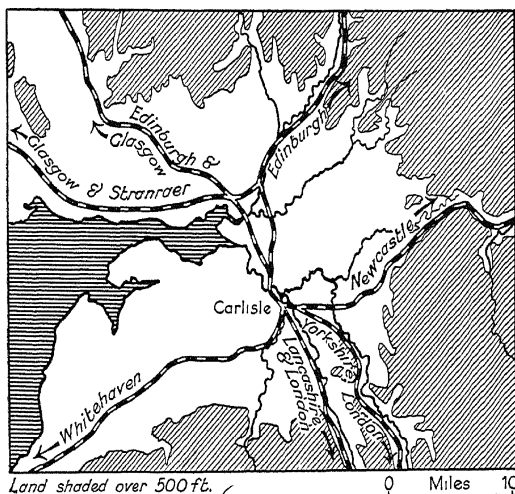


FIG. 22. The main English and Scottish railways converging on Carlisle.

the railway engine works ; a branch line strikes west through Chester and follows the north coast of Wales, as the Great Western line does the south, to one of the ports for steamers to Ireland—Holyhead on an island off the coast of Anglesea. The main line runs north from Crewe through the populous lowland of Lancashire, with branches to Manchester (from Crewe and other junctions), to Liverpool, and other big towns. It touches the coast from which the route is named at Morecambe Bay, and climbs more than 900 feet over Shap Fells between the Lake District and the Pennines. Then it drops to the Solway plain and the city of Carlisle. This is an important route-centre between England and Scotland ; besides the west coast line, railways converge upon it from the Cumberland coast, the Eden



valley, and the Tyne gap (to be mentioned presently) from the English side, and four lines across the southern uplands of Scotland. Of these last, our main line runs up Annandale, comes into the upper valley of the Clyde, and branches through the Scottish lowlands, eastward to Edinburgh, westward to Glasgow. The line north

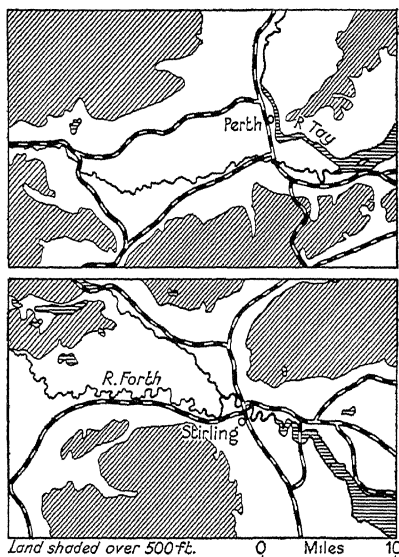


FIG. 23. THE POSITIONS OF PERTH AND STIRLING, which offer an interesting comparison in relation to the valleys, the hills, and the firths.

runs across the middle of the lowlands to Stirling, a town on the Forth, the position of which should be studied on a map, in relation to the lowland and the Firth of Forth, the hills on either side of the river, the straths north and west of them, and the route westward into the highlands up the valley of the Teith. Our railway continues to Perth, which stands in relation to the Firth of Tay as Stirling does to that of Forth, and commands Strathmore and a route north-east to Aberdeen. The route north runs up the Tay valley, climbs over a high pass in the Grampian hills, enters Strath Spey, and then crosses hills and glens north-westerly to Inverness, at the outlet of

Glen More to Moray Firth. Beyond this, the railway, partly following the coast, partly running inland, extends to Wick and Thurso in Caithness.

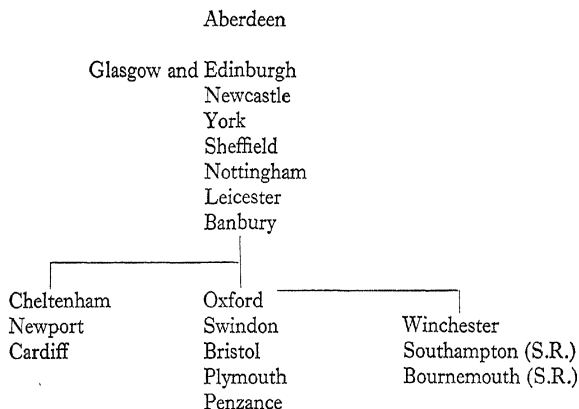
Another main line of the L.M.S.R., and also one of the L.N.E.R., run from London through the midlands, serving Leicester, Nottingham, &c. They converge in the Erewash valley, which carries them north along the eastern edge of the Pennines to Sheffield. The L.M.S.R. has a line from Derby to Manchester, following the Derwent valley into the hills, and the L.N.E.R. one from Sheffield, following the upper Don; these lines run respectively south and north of the Peak. North of Sheffield the populous valleys of the Pennines are full of railways, and there are several routes across the hills, from east to west. The L.M.S.R. line above mentioned reaches Leeds, and then passes up the Aire valley, which gives one of the easiest natural routes across the Pennines. The line then ascends the upper Ribble valley, and climbs high (1,250 ft.) over the divide into that of the Eden, down which it runs to Carlisle. Between the Aire gap and the Tyne gap there are only two railways of small importance across the Pennines, for here we are beyond the populous industrial valleys.

The London and North Eastern Railway system includes the 'East Coast' route from London to Scotland. Leaving London it needs several tunnels to pass the low hills which border London on the north. After running between the Chiltern and East Anglian hills it descends upon the lowland bordering the Fens about Peterborough, and it continues over lowland, keeping well east of the Pennines, past Doncaster and northward up the Vale of York and the city of that name, which is a route-centre for the whole of Yorkshire. The line reaches the Tyne at the port of Newcastle, and crosses the river by a high bridge. Here the branch to Carlisle already mentioned turns west through the Tyne gap. The main line turns the eastern end of the Cheviot Hills at Berwick, skirts the east coast, and reaches Edinburgh, whence it connects with Glasgow, the lowlands, and the highlands. The main line runs near the east coast through Dundee to Aberdeen, and to shorten distance it crosses the firths of Forth and Tay by huge bridges—the Tay Bridge the longer (over 2 miles), but the Forth Bridge, with wider spans, one of the biggest and most remarkable structures of its kind in the world.

## The British Isles

The L.N.E.R. also serves East Anglia and the east coast of England (north of the Thames) generally.

In addition to the main lines described, starting from London, there are several important links for through traffic between different systems. One example is the line which, from Banbury, connects the G.W. and L.N.E. systems. Thus we find through passenger traffic worked between Aberdeen and Penzance, and between other points on the following routes, which are worth study :



Another important link is the L.M.S. line from Bath and Bristol into and up the Severn valley by Gloucester and Worcester to Birmingham and Derby ; and another the L.M.S. and G.W. joint line connecting Hereford (and so South Wales, Bristol, and the south-west of England) with Shrewsbury and Crewe (whence Lancashire, Yorkshire, and the north). A direct route connects this line with Swansea through the Welsh highlands, and in considering these and other routes mentioned on p. 56, we notice the importance of Shrewsbury as a route-centre for Wales, although it is not in Wales. Within Wales, with its sparsely inhabited central highlands, there is no large centre of population in equally easy connexion with the whole country.

Among further ' cross-country ' railway routes for study are (1) that from the Kent coast (Dover, &c., S.R.) by Tonbridge and Red

Hill to Reading (G.W.) and so to Oxford, Birmingham, Shrewsbury, and Birkenhead as already described ; (2) that between Lancashire and East Anglia by Sheffield, Lincoln, and March (L.N.E.R.).

*Roads.*—Great Britain has a complete system of roads, which has existed, at least in part, for many centuries. Probably the ‘rail-ways’ had their origin, long before the invention of the steam-engine, in the badness of some of the roads. By way of improving them, ‘rails,’ at first of wood, were laid for the wheels of carts to run upon. As steam railways developed, the roads became more and more used for small local traffic only, and as feeders to the railways. With the development of motor vehicles, the roads became again important for long-distance and much heavier traffic, and many of them are now found insufficient. Widening them, and building new roads, became necessary ; ‘by-passes’ are needed to carry long-distance traffic aside from towns and villages instead of through them, in something the same way as we found the Great Western Railway (p. 56) by-passing Bristol and other towns on its old main line (and there are other instances of this).

*Rivers and Canals.*—With inland canals and river navigations it is otherwise : the railways largely replaced them for the carrying of goods, and some navigations are now disused. Inland navigation has not been developed in Britain as it has in some parts of Europe, because the rivers are smaller and cannot easily carry so much traffic ; the country where canals find most traffic (the manufacturing districts) is generally hilly and many locks are therefore necessary, and the canals are mostly small, having been built when trade was not nearly so large as it is now. Schemes have been made for improving the canals which might be most useful, especially those connecting the midland industrial districts with seaports. Among waterways which still carry a fair traffic, the Grand Junction Canal connects London with the Midlands, and the Birmingham Canal Navigations connect with the rivers Severn and Trent, both of which have considerable traffic. The Trent and Mersey canal connects those rivers by way of the Potteries, and the river Weaver carries traffic between the Cheshire salt-works and the Mersey. A waterway is made across the manufacturing district of the Pennines by the Aire and Calder Navigation from Goole to Leeds, and the Leeds and Liverpool Canal. Far more important than any of these is the Manchester Ship

Canal, which has made a great seaport of Manchester, connecting it with the Mersey. In the Scottish lowland there is a small canal from the Clyde to the Forth, and proposals have been made for a ship-canal. The Caledonian Canal connects the lochs in Glen More and through them the west coast with Inverness, but the shipping is small.

*Communications and Old Town-sites.*—On an earlier page (33) we found that certain geographical conditions connected with communications often influenced the positions of towns. We may look at a few examples now. In early times it would be natural for a town to grow where travellers were brought together, and perhaps delayed, by having to ford a river : many towns have the word ‘ ford ’ as part of their names. The same would apply to a bridge over a river of any considerable size : bridges were few, and roads would converge upon them from different directions. Still more people would be brought together if the river were navigable, for those travelling by boat would meet those travelling by land. The importance of the river-navigation would be increased if the river were navigable from the sea. The highest point reached by the tide in a river, where goods were transhipped between sea and land, might be a favourable site for a town : such a point was sometimes at or near the head of an estuary, where, moreover, a bridge could cross, whereas none could be built over the wider estuary. It may be remembered in this connexion that long ago, when ships were smaller and coal-fields were unworked, the conditions and directions of trade were far different from those of modern trade. Some places were of much greater importance as seaports, relatively, than they are now. Important fords and bridges had often to be defended by forts or castles, and town-populations naturally came together under their protection. Such towns, besides centres of trade, became also centres of religion, and at some, stately abbeys or cathedrals were built, and remain among the noblest memorials of British history. Points at which valleys converge, affording easy lines of road, especially through hilly country, are usual sites for towns. Towns which formerly were important road junctions, now are often railway junctions as well.

Such conditions as these influenced the original positions of many of the towns mentioned already, though different geographical reasons for their present importance may have been given. London

is a case in point. On p. 48 certain reasons were given for its pre-eminence. But in very early times the first London grew up where the 'city' of London now stands, on land a little higher than the low ground which for the most part borders the lower Thames, and used to be marshy or wooded. This point is not far above the head of the estuary of the river ; and when bridge-building was learned it was found possible to build one here, but not lower down the river. As an exercise it is worth trying to find whether any conditions of this sort seem to apply to the positions of other great towns already mentioned ; but we will now look at a few further examples in England which closely illustrate these points. Take Canterbury for instance : the famous city in Kent which contains the cathedral of one of the two archbishoprics of the Church of England, and was the first great centre of Christianity here. A good map shows how routes naturally converge upon it from the coast to the north, east, and south-east, from the north-west over a spur of the North Downs, and from the south-west through a gap in those hills, the valley of the Stour. Moreover the Stour was once navigable from the sea to a point very near Canterbury. Take again two of the chief towns in East Anglia—Norwich and Ipswich. At Norwich roads converge for a crossing of the river Yare, which used to be of importance for navigation up to this point. Ipswich stands at the head of the Orwell estuary, where a bridge crosses ; and this is one of the towns formerly of greater relative importance as a seaport than it is now.

It is natural to consider together Oxford and Cambridge, the two seats of famous ancient universities in England. Oxford stands on the navigable upper Thames, where fords crossed the several streams into which the river breaks at this point. Here was a passage across the frontier between two ancient kingdoms (Mercia and Wessex), which, as such, was a point of defence. It became a religious centre, and, based upon this, a centre of learning. Cambridge stands at a river-crossing, and on a natural route-line which passed between the fen-country on the one hand and on the other the once forested 'uplands', as the country of the upper basin of the Great Ouse is still called. Its river (the Cam) also was navigable, from the Ouse, up to this point. It was in touch of the religious foundations in the Fen country (Ely and Peterborough have been mentioned already), but

easier of access than they ; and hence, as in the case of Oxford, it became a centre of learning. Both towns were fairly centrally placed for easy access by students from large parts of England—and parts more important formerly, before there were so many large towns in the north.

We take next four examples of towns, the names of which have a common feature—Leicester, Worcester, Gloucester, Chester. The termination ‘-cester’ and the name ‘Chester’ (which also appears as a termination of many place-names) imply the existence of a fortified place at least as early as the Roman period in Britain. Leicester was such a town, at a crossing and head of navigation of the river Soar. Worcester was at a crossing of the river Severn, on its middle course, between Gloucester in the south and Chester in the north : from the opposite (right) bank of the Severn, near Worcester, the valley of its tributary the Teme leads westward into the hill-country toward the Welsh Marches. The positions of Gloucester and Chester are worth comparing. At Gloucester, but not lower down, the Severn is bridged, and a main road passes over, leading to South Wales : so also, in modern times, did the main railway from London to South Wales, before the Severn Tunnel (p. 56) was made. Chester, similarly, was placed on the Dee, not far above its estuary, and the main road to north Wales, and now also the railway, cross here. The Dee in earlier days was of some importance for navigation from the sea. Gloucester, from its position, might be thought to be well placed as an estuary port, but it is not ; the upper part of the estuary is full of shoals, and high tides, as they flow up it between the narrowing shores, are raised in a wave known as the bore, which may be dangerous. A canal for small ships leads from the estuary to Gloucester.

Other places of which the positions may be studied on these lines are, for example, Exeter at the head of the Exe estuary in the west country ; York, again, centrally placed on the plain of York, up to which point the Yorkshire Ouse is tidal and used to carry shipping from the Humber and the sea. But it must again be made clear that in this general book only a few examples out of many can be given, and that it is a good exercise to find and study others.

## IRELAND

*Surface.*—We have found that Ireland consists of a central lowland, bounded to the north and south by separated groups of highlands. There are highlands also to the west, but the lowland reaches the Atlantic coast at Galway Bay. On the east coast it borders the Irish Sea from Dublin Bay north toward Dundalk Bay. The central lowland divides into an eastern part, the basins of the rivers Boyne and Liffey, which flow to the Irish Sea, and a western part, which is almost all within the basin of the Shannon, the largest river in Ireland. The lowland has generally a gently sloping surface; in some parts it is flat, as for instance in the Bog of Allen, which covers much of the southern part of the lowland, between the Liffey and Shannon valleys. This is the largest of the Irish bogs (which altogether have been reckoned to cover nearly a seventh of the whole area of the country). The Bog of Allen extends over 370 square miles, but is traversed by strips of firm ground. It is notable that in this part of the lowland, and not in the surrounding highlands, are the main headwaters of the rivers Boyne flowing north-east, Barrow, flowing south, and Brosna, flowing west (to the Shannon). To the south-east in the Liffey valley lies the Curragh, a flat track of soft turf covering 12 square miles; its name, meaning a race-course, points out a use for which it has long been famous, and still is. The central lowland is for the most part open and treeless. The green fields of the firmer land contrast with the brown desolate bogs. The vivid green of the richer grasslands, both here and elsewhere in Ireland, justify its poetic name, the Emerald Isle.

*The River Shannon* is about 230 miles long; rather longer, that is, than the Severn and the Thames in Great Britain: but the area of the basin is less, being 4,500 square miles or nearly one-seventh of the whole area. The basin lies mostly north and south, but the river bends south-westward to a long estuary in the west coast. In this respect it may be compared with the Severn, but otherwise the rivers differ. The Shannon, flowing slowly over the central lowland, passes through many lakes (called loughs in Ireland, pronounced like the Scottish 'lochs'), which the Severn and Thames do not. Most of these lakes show a type of formation common to many hundreds which dot the surface of Ireland, and form one of the chief beauties



of its scenery. They are shallow basins made by solution of the limestone of which the lowland and its branches are composed. Below the foot of Lough Derg, the largest of the Shannon lakes, the river leaves the lowland and flows with a swifter course to its estuary, forming some heavy rapids. Large works have been designed to make use of its power in generating electricity. The central lowland is part of the Irish Free State.

*The Highlands.*—North of the central lowland the highlands are (1) the Mourne Mountains, rising from the east coast north of the fiord of Carlingford Lough ; (2) the Antrim plateau in the north-east, eastward of the river Bann ; (3) the northern highlands, west of the Bann, and between it and the river Foyle—all of which divisions belong to the state of Northern Ireland—and (4) the north-west or Donegal highlands, within the Irish Free State. The Mourne Mountains are a beautiful group with steep sides often sheer and rocky, and rounded summits. They are of igneous rocks, and they and the adjacent formations (not igneous) are related to those of the Southern Uplands of Scotland, but the mountains themselves are bolder than any there. The Antrim plateau, north of the inlet of Belfast Lough, rises to nearly level summits up to 1800 feet high, with steep sides. It is formed largely of the volcanic rock basalt, and along the north coast, as in the so-called Giant's Causeway, the curious formation of columns may be compared with that in some of the western Scottish islands.<sup>1</sup> The river Bann drains Lough Neagh, the largest in Ireland, a lake formed by faulting where the sheets of volcanic rock cracked and sank. The volcanic rocks extend across the lower Bann valley into the northern highland group, which, for the rest, is similar to the north-western highlands and to much of the Scottish highlands, as we have seen (p. 10). There is noble coast scenery in Donegal, as where, in Slieve League, the hills are cut off sheer to the ocean. To the south of the northern and north-western highlands the river Erne, rising on the borders of the central lowland in the Free State but passing partly through Northern Ireland, drains an immense number of solution lakes and wanders through many channels among picturesque wooded islands, to its mouth in Donegal Bay.

The west of Ireland, between Donegal and Galway bays, is a wild

<sup>1</sup> See further, Part II, p. 430.

territory of rugged mountains and moors, lakes and bogs, where the limestone reaches the sea in sheer cliffs on the north, but much of the highland is related to that of the north-west. High islands lie off the coast. The finest mountain-group is that of the Twelve Bens in Connemara, a district extending west of the big Lough Corrib, north of Galway Bay, and south of the long mountain-girt fiord of Killary Harbour. Many of the highland lakes are of glacial formation (p. 10). And here it may be noticed that evidences of glacial action are common in Ireland ; not only in lake-formation, but in the distribution of erratics (ice-borne rocks), the striation or scratching of rock surfaces, and the formation of long ridges of gravel called eskers, and of the hillocks called drumlins.

The south-western highlands, south of the Shannon estuary and west of the river Barrow, consist, broadly speaking, of parallel folded ranges, which along the south-west coast are separated by long sea-inlets. These are not of the form of fiords, deep within and shallower toward the mouth, but of rias, deepening from a shallow head. In Macgillicuddy's Reeks, one of the south-westerly mountain-groups, the highest point in Ireland is found (3,400 ft.), with other fine summits ; and hereabouts is some of the loveliest scenery, in the lakes of Killarney and their surroundings. The rivers Lee and Blackwater, rising in the south-western highlands, flow east, but in their lower courses turn suddenly south into Cork Harbour, and Youghal Bay respectively. The Suir, after watering part of the rich Golden Valley, also flows east to Waterford Harbour, which receives the Barrow (p. 65) from the north. The south-eastern highlands, between the Liffey, the Barrow, and the east coast, consist chiefly of the Wicklow Mountains. They rise in the north-east almost sheer from the coast, but farther south they are fringed by a coastal lowland. Their sides are flanked by richly wooded vales such as that of Ovoca ; their summits are moorlands of easy slopes, and they may be compared fairly well with the Welsh plateau, the rock-formations being largely similar.

*Population.*—We have seen (p. 16) that the population of Ireland is small in comparison with that of England. There are no great centres of close population, as in and around London, and the big manufacturing and mining districts of England, South Wales, and the Scottish lowlands. Population is fairly dense immediately round

the city of Dublin, and in that part of Northern Ireland (roughly between the Mourne Mountains, Lough Neagh, and Belfast) which includes the only large manufacturing district in the island. The population is very sparse all over the southern part of the central lowland, and of course in the highlands generally. In some parts, however, especially in the west and north-west, there is quite a dense population on habitable tracts, not mountain wastes and bog-lands; and this in spite of emigration and other causes which in the course of about 70 years reduced the population of Ireland by half. Some of these lands ('congested districts', as they were called) are themselves too poor to support in comfort the people who live on them; but other parts could support a larger population than they have now. All the largest towns are seaports. As our description has suggested, much of the coast of Ireland is steep and difficult for shipping, but it is broken by a number of fine natural harbours, and large towns have grown up on some of these: Belfast on the east coast and Derry (Londonderry) on the north coast in Northern Ireland; Dublin on the east coast, Waterford and Cork on the south coast, and Limerick on the Shannon estuary in the Free State.

*Provinces.*—Ireland was divided of old into four provinces, the names of which have remained in use. Ulster, the northern province, was larger than the present State of Northern Ireland, as it included Donegal and extended farther south; but its name is commonly used of the state. Leinster, the eastern province, extended from Dundalk Bay to Waterford Harbour, and was separated from Connaught, the western province, along the middle course of the Shannon. Connaught extended from Donegal Bay to Galway Bay. The south-western province was Munster. Each province contained highlands and lowlands, sharing the fertile lands of the central lowland and its branches, and also the woods which formerly covered much of the lower lands.

*Agriculture and Live stock.*—Roughly two-thirds of Ireland consists of arable and pasture land; pasture being nearly double arable in extent, a much higher proportion than in England. The chief grain crops are oats, barley, and wheat; oats are grown most widely, barley and wheat principally in the east, where the rainfall is least heavy. There is a comparison here with Great Britain; but the decrease in Irish grain crops, especially wheat, has been very great.

The barley supplies (not completely) the industries of distilling whisky and brewing porter. Some flax is grown in Ulster, but not nearly enough for the linen industry. Potatoes, especially in the west and south, are an important food-crop of the country people. Pastoral industries are much more important than grain-cultivation in Ireland. The richer pastures feed many cattle, especially in the centre, east, and south. There is a large dairying industry; the waste products feed pigs, the keeping of which is a typical feature of Irish farming. It has led to industry in bacon-curing, which has its chief centre in Limerick, but is widely distributed. Horse-breeding is another typical feature. Sheep are reared principally in the west and in the east. The sea-fisheries are rich, but the coasts, lying open to the Atlantic storms are unfavourable for the fishing industry; moreover, the fisheries are distant from towns and populous districts which need large supplies of fish. Some of the rivers have good salmon and trout fisheries.

*Minerals.*—Ireland is not rich in minerals. There are a few small coal-workings; but the rich coal-measures or coal-bearing rocks which occur in Great Britain in some of the carboniferous areas have been mostly removed by denudation from the similar areas in Ireland. It is believed, however, that where coal-measures remain in Ireland, deeper working might yield more coal. Peat, which is burnt as home fuel, may be put to various other uses, such as the making of gas, paper, stable litter, manure, &c., but these uses have not been largely developed in commerce.

*Manufactures.*—It has been seen that the principal industrial district is that in Northern Ireland which extends inland from Belfast over the country south of Lough Neagh, and manufactures linen. Out of this developed the manufacture of shirts, for which Derry is the chief centre; it extends also into the cottages of the country people. Hosiery is made at Balbriggan near Dublin; woollen cloth is woven in many parts of the country, almost entirely in the homes of the people, as is lace, for which the south is chiefly noted. A manufacture of the fine material called poplin centres at Dublin. The industries of brewing and distilling have already been mentioned. The first has its chief centre in Dublin and is carried on mostly in the Free State; the second is common to both the Free State and Northern Ireland, as there are large distilleries in Dublin,

Belfast, Cork, and many other places. The ship-building industry is connected chiefly with Belfast, where some of the world's largest ships have been built. Coal is easily got from Scotland and Cumberland for the Northern Irish industries.

*Communications* between Great Britain and Ireland are carried on principally by the following routes (from south to north): Fishguard (Wales) to Rosslare; Holyhead (Wales, Anglesea) to Dublin;

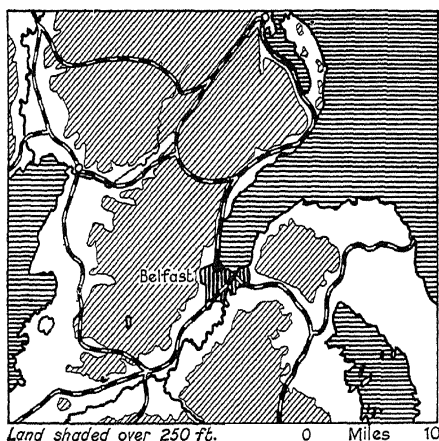


FIG. 24. BELFAST.

Liverpool and Heysham (Lancashire) to Belfast; Stranraer (Scotland) to Larne; Glasgow to Belfast. The shortest routes are Fishguard-Rosslare, 54 miles, across St. George's Channel, Holyhead-Dublin (Dun Laoghaire), 60 miles, across the middle of the Irish Sea, and Stranraer-Larne, 31 miles, across the North Channel. Dun Laoghaire (Dunleary; formerly Kingstown, and still often so called) is the outport of Dublin at the mouth of the Liffey, but steamers also sail up to the city. The position of Dublin, centrally on the east coast, opposite Holyhead and English ports, gives a good geographical reason why Dublin became the capital of Ireland, and now of the Free State. Further, it is at the chief natural outlet of the central lowland to the Irish Sea, and we shall

find that communications are easy from it to all parts of Ireland. The chief ports for Atlantic passenger ships are Cork in the south and Derry in the north. Cork has an outport, Cobh (i.e. Cove; formerly Queenstown), on an island in Cork harbour, and Derry has that of Moville at the mouth of Lough Foyle.

Inland communications in Ireland are on the whole easy, because the central lowland offers easy ways across the middle, and com-

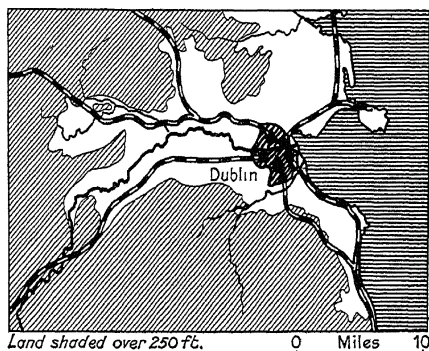


FIG. 25. DUBLIN.

municates with the north and south through branches or valleys between the highlands. There is a fair system of roads. The main road from Dublin to the west follows for a long distance the firm line of an esker ridge (p. 67) across the central lowland. The principal railways belong to the Great Southern, Great Northern, and Northern Counties systems, the last of which is part of the London, Midland, and Scottish system of Great Britain. One main line of the Great Southern skirts the Wicklow Mountains south from Dublin along the coast to Wicklow; then, running mostly inland through the south-eastern lowland, reaches Wexford and Rosslare. A second main line, south-westward from Dublin, follows the natural route which leads across the upper valleys of the Barrow, Nore, and Suir (the Golden Valley), and then after crossing the Blackwater at Mallow runs south-east to Cork by an easy pass through the south-western highlands. A third main line crosses the

central lowland from Dublin to Galway and beyond. The principal line of the Great Northern connects Dublin with Belfast, running along or near the coast as far as Dundalk, and then following the natural route through the gap at the head of Carlingford Lough (west of the Mourne Mountains) northward into the lowland of the Bann. The Northern Counties lines connect Belfast with Larne and the counties of Antrim and Derry. Thanks to easy natural routes, the Irish lines have few big embankments or tunnels. Traffic is not heavy on most of them, and, unlike the railways in Great Britain, about five-sevenths of them are single-tracked.

*The Channel Islands* (p. 16) are connected physically with north-western France, near which they rise from a shallow sea studded with islets and rocks. The people commonly speak French. The chief beauty of the islands is in their steep rocky coasts and little sheltered bays and beaches. The two principal islands are Jersey and Guernsey. Fruit, vegetables, and flowers are largely cultivated (cf. p. 36), cattle are bred, and the fisheries are of some value.

*The Isle of Man* in the Irish Sea consists, except in the north, of moorland hills separated by deep rocky glens, and often falling steeply to the sea in fine cliffs. There is some agriculture and fishing, and the island yields lead and other metals, formerly of greater importance.

Both the Channel Islands and the Isle of Man, however, owe much of their prosperity to holiday visitors from Great Britain.

### EXERCISES

1. What are the chief geographical contrasts between (a) the north-western and south-eastern halves of England, and (b) Scotland and Ireland? In (a) a rough dividing line is given on p. 7. Suggest a line which divides these regions more exactly. Describe in detail the chief natural features of any one (e. g. the Lake District) of the high-land districts of Great Britain.

2. The east and south coasts of Great Britain are comparatively smooth, while the west coast—especially in the north—is much indented. How do you account for these differences?

3. What advantages does Britain possess by its position (a) on the continental shelf, and (b) on the north-western margin of Europe?

4. Give an account of the geographical conditions affecting the

work of a farmer in (a) East Anglia ; (b) Cheshire ; (c) the Cheviots ; (d) the plain of Strathmore ; (e) southern Ireland.

5. Draw a rough sketch-map of the district in which you live, marking and naming the important physical features. Write a short description of the positions of towns and villages, occupations of the inhabitants, and lines of communications.

6. Which parts of the British Isles receive (a) heaviest rainfall, and (b) lightest rainfall ? Explain how this rainfall is influenced by position, altitude, and slope of the locality.

On a map of the British Isles, shade in areas which have 30 inches or more of rain during the year.

7. How do cyclones and anticyclones affect our weather ?

8. On a map of the British Isles draw the mean winter isotherm of  $40^{\circ}$  F. ; and the mean summer isotherm of  $60^{\circ}$  F. ; so dividing the area into four sections. Name the districts (or counties) lying in each section, and note the differences between sections in (a) the seasonal distribution of temperature ; (b) the mean annual temperature, and (c) the mean range.

9. Explain the difference in the direction of the isotherms during summer and winter.

10. Using your own signs, show on a map of the British Isles the following details :

- (a) Forests.
- (b) Agricultural areas with chief crops.
- (c) Chief cattle-farming districts.
- (d) Chief sheep-farming districts.
- (e) Heath, moor, &c.

11. Draw a map of England south of the Thames and Severn, showing scarplands, rivers, gaps, railway routes, and chief towns. Also indicate lines of communication between coast towns and those on the continent.

12. Examine other main routes leading from London to other parts of Great Britain, with special reference to the following :

- (a) the use made of river valleys and gaps ;
- (b) where detours are made or tunnels used ;
- (c) the chief towns on each route and important junctions ;
- (d) length of journey and approximate time taken ;
- (e) the scenery.

13. Select one of the following rivers : Trent, Severn, Tweed, Thames. Indicate the chief physical features and natural resources of its basin, and point out the resultant human activities.

14. What explanations can you give of the comparative lack of



manufacturing prosperity in Ireland ? Which is the most prosperous part of Ireland, and why ?

15. Describe the distribution of coal-fields in England and Wales. Show how the positions of the coal-fields in northern England are related to the mountains and rivers.

16. Write notes on the density of population in (a) the Scottish Highlands ; (b) Salisbury plain ; (c) the East Riding of Yorkshire. Point out the geographical conditions affecting the density of population in each case.

17. Compare and contrast the distribution of population in Scotland and Ireland, and in each case suggest what factors have been of importance in influencing the distribution.

18. Give an account of the distribution of iron-ore in England and Wales, and the centres where iron is smelted.

19. Give geographical reasons for the localization of the cotton industry in Lancashire, the woollen industry in the West Riding of Yorkshire, the steel industry at Sheffield, and the ship-building industry at the Tyne ports.

20. Name six of the important fishing ports of the British Isles. What fishing grounds are made use of by the fleets of each of these ports ? What disadvantages are suffered by the Cornish fishing fleets in competing with the fleets of Grimsby ?

21. Name and account for the industries carried on in each of the following regions : (a) the Potteries ; (b) the Black Country ; (c) the South Wales coal-field ; (d) the plain of Hereford ; (e) the district in which you live.

22. What is meant by market-gardening ? How far is its development in England influenced by the growth of large towns ?

23. Describe the positions of the following ports : Bristol, Liverpool, Hull, Dover, and Glasgow. Compare the natural advantages possessed by them.

24. Compare (a) the climate of Great Britain with that of New Zealand, and (b) the position of Great Britain with that of Japan as regards facilities for trans-oceanic trade.

### III. EUROPE: THE CONTINENT

*Extent and Shape.*—Looking at the map of the eastern hemisphere, we see that Europe appears as a western extension of Asia. In some ways it has less right to the name of continent than any other area so called. It consists of two large peninsulas, a number of smaller peninsulas jutting out from them, and many islands, of which the two largest are Great Britain and Ireland.

Excepting Australia, it is the smallest of the continents. Owing to its many peninsulas and islands and to the irregularity of its coastline, it is difficult to obtain the exact area and to get the correct length of coastline; and we find different figures given in different books. It is sufficient if we take the area as  $3\frac{3}{4}$  million square miles—not a difficult figure to remember. The coastline measures about 19,820 miles, which gives roughly one mile of coast to 180 square miles of area.

Europe extends from latitude  $71^{\circ}$  N. at Cape Nordkyn (Norway) to  $36^{\circ}$  N. at Cape Tarifa (Spain) and from longitude  $66^{\circ} 20'$  E. of Greenwich in the Ural mountains to  $9^{\circ} 27'$  W. of Greenwich at Cape St. Vincent (Portugal). Its northern point is over 300 miles within the Arctic circle: its southern point is nearly 900 miles north of the Tropic of Cancer.

*Relation with Asia.*—As Europe is of peninsular form, it has land boundaries only on the eastern and south-eastern margins. It is difficult to trace a clear natural division between this continent and Asia. The simplest line follows the Ural mountains from north to south; the Ural River, from these mountains south to the Caspian Sea; the Caucasus mountains; the Black Sea; the Bosphorus; Sea of Marmara, and Dardanelles; the Aegean Sea.

Because Asiatic peoples live on both sides of the Caucasus Mountains it has been suggested that the boundary should run farther to the north, and some place it along the Manych depression, which runs east from the head of the Sea of Azov through the low and sparsely inhabited country at the north end of the Caspian Sea.

From a study of the physical features it would appear that Eurasia—Europe and Asia—should be treated as one land unit, but there are

many reasons why Europe should be taken as a separate continent. The names are probably of Asiatic origin, meaning the land of the rising sun (Asia, east) and the land of the setting sun (Europe, west). The ancient Greeks learned these names, and as their land and countries joining it on the north are separated by sea from Asia Minor and other countries to the east, they needed names to distinguish them. And later, Europe has become the home of nations very different in regard to civilization and physical characters from those whose homes are in Asia, or in Africa, which is the third continent of the Old World.

*The European Seas.*—On the north, west, and south of Europe water boundaries are formed by the Arctic Ocean, the Atlantic Ocean, and the Mediterranean Sea respectively. Besides the Mediterranean Sea there are many smaller seas which border on, or penetrate, different parts of the Continent. In the north-west the Baltic Sea runs far into the land, and in the south-east the Black Sea may be considered as a north-eastern extension of the Mediterranean. In addition there are other branches from the Mediterranean. Not only does this give a great length of coastline but it also ensures that no part of the continent is far from the sea. Excepting the eastern part of Russia no land is more than 400 miles from a sea-board. As will be explained later, this has an important influence on climate ; in addition, the continent is well placed as regards sea routes. Apart from its latitude, there are two important advantages in position which Europe possesses ; one is its position on the western margin of the Old World, facing the New World, and the other is that it holds a central position among other land-masses. Its place on the eastern side of the North Atlantic Ocean ensures for the greater part a fairly uniform climate and a good supply of rain.

The Mediterranean Sea and the outlet at its eastern end by the Suez Canal give the quickest route to the East ; the routes across the Atlantic Ocean connect Europe with the great commercial centres of the New World, and direct routes lead to the southern continents.

*The Map* of Europe is one of the least simple of continental maps. We need to form a network of meridians and parallels, and then to pick out some points in relation to these lines. In order to remember these points, it is necessary to look at the atlas many times. The

meridian of Greenwich cuts no land north of the eastern part of Yorkshire. Southward, it runs nearly through Havre at the mouth of the Seine ; it cuts the Pyrenees near the middle of the range, and all but the north-east of Spain lies west of it. The line of  $10^{\circ}$  W. long. skirts the west coasts of Ireland and the Iberian Peninsula. The line of  $5^{\circ}$  E. long. is very useful : it just skirts the south-west coast of Norway and runs through the Low Countries, cutting their coast where this turns from west to south-west. The line crosses France to near Marseilles. The central meridian of the map is usually  $20^{\circ}$  E. long. This runs  $5^{\circ}$  to the west of the most northerly point of Europe, and through the middle part of the Baltic Sea. Certain important towns lie on it, such as Königsberg (Baltic coast) and Cracow in south-west Poland ; and it divides the important middle plain of the Danube into two equal parts. It strikes the Mediterranean Sea just east of the entrance to the Adriatic. The line of  $35^{\circ}$  E. long. runs through the western part of the White Sea and through the middle of the Black Sea ; that of  $50^{\circ}$  E. long. through the Caspian Sea, and that of  $60^{\circ}$  E. long. almost exactly along the top of the Ural Mountains.

The Arctic circle just touches the north of Iceland, cuts Scandinavia not far north of the head of the Baltic Sea, and cuts the strait at the entrance to the White Sea. The line of  $60^{\circ}$  N. lat. cuts the Shetland Islands, Oslo in southern Norway, Leningrad at the head of the Gulf of Finland, and the Ural Mountains about their middle. On  $50^{\circ}$  N. lat. we can place the extreme south point of England (Cornwall), Frankfurt-on-Main in Germany, and Cracow (this is a good central point ; the intersection of the central meridian and the 50th parallel). Lat.  $45^{\circ}$  N. passes near Bordeaux, across the head of the Adriatic Sea, through Belgrade, and through the delta of the Danube ; and cuts the Crimea and the north of the Caspian Sea. Belgrade is a good point to remember, for it lies near the intersection of this parallel and the line of  $20^{\circ}$  E. long. (i. e. it lies due south of Cracow).

All the western Mediterranean Sea lies north of  $35^{\circ}$  N. lat. but most of the eastern Mediterranean lies to the south of that line, which cuts through the islands of Crete and Cyprus. This part of the map is rather difficult to draw, so it would be as well to remember the position of the  $40^{\circ}$  N. line as well.

The network formed by these meridians and parallels will give a framework in which to draw the rough map.

There are seven peninsulas, which have to be fitted into their right places :

Scandinavia (Norway and Sweden).

Jutland (Denmark).

Brittany.

Iberia (Spain and Portugal).

Italy.

The Balkan Peninsula.

The Crimea.

*Coasts.*—Besides these peninsulas there are many smaller, but for the purposes of our rough map they are not important. In other ways, however, they are of great importance. As we have already seen, they give great length of coastline, and so many indentations provide plenty of harbours or channels for ships. Besides the ordinary irregularities of the coast, other safe places for ships to lie are found in the estuaries of rivers. If we look at a map we can easily see how well off Europe is for good harbours. But if these harbours are to be really useful, they must be easy to approach, not only from the sea, but also by roads and railways from the interior of the land. Europe has many large rivers, and for purposes of communication they are very important, especially in southern Europe where a belt of mountains crosses the continent. Along the valleys of the rivers it is easier to build roads and railways, and in mountainous country they provide the only routes. A good example of this is shown by the communications of the Balkan States. The valley of the Danube is the main route from central Europe. From Belgrade the route to the south follows the river Morava to Nish : from Nish one railway goes to Sofia and on through the Maritza valley to Adrianople and thence to Constantinople. The second line from Nish runs south and follows the Vardar valley to Salonika. These cities, which lie at the ends of land-routes and also possess good harbours, are important for those reasons. Where the land is flatter, as for example in north-western Europe, communication by land is not so difficult, and we find that ports are more numerous. But low coasts do not always possess good harbours. The west coast of France is low and straight and is therefore unsheltered from

the nasty storms which strike the Bay of Biscay. The only harbours are provided by the estuaries of the rivers Garonne and Loire. The low coast of the North Sea, as far as the Jutland peninsula, is sandy ; the waters are shallow, and here again we find that the ports are on big rivers.

Shipping can get at three sides of Europe, and penetrate the continent deeply by such inlet-seas as the Black Sea, Adriatic, and Baltic. The north European seas are specially favoured because, considering their high northern latitude, they are not much liable to be frozen in winter. The drift of warm waters from the south-west across the Atlantic Ocean keeps open all the year the waters surrounding the British Isles and the Norwegian seas. The seas help to moderate the climate, and they yield fish, an important food-supply for the populous countries which border them.

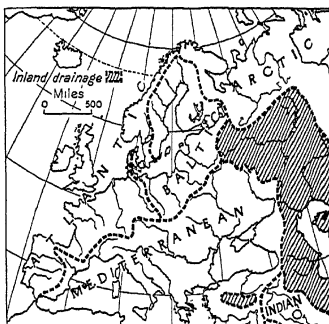


FIG. 26. OCEANIC DRAINAGE AREAS OF EUROPE.

The continental shelf is extensive to the north-west of Europe ; we have seen (p. 5) that the British Isles stand on it. The 100-fathom line, which marks the edge of the shelf, runs north of the North Sea and west of the British Isles. This is important for two reasons. It gives a large expanse of fishing grounds ; and the tides are strongly felt in the shallow waters.<sup>1</sup> A strong tide flushes out estuaries and harbours and the flow of water helps ships to ascend and descend estuaries and other inlets.

There are only small tides in the Baltic because it is nearly land-locked.

The western Mediterranean, eastern Mediterranean, and Black Seas consist of deep basins connected by shallower channels, and throwing off shallower inlets, such as the Adriatic Sea and the Sea of Azov. The Straits of Gibraltar are very narrow, so that these seas also are little affected by tides.

<sup>1</sup> On tides cf. Part II, p. 500.

*Surface Features.*—There are three main divisions :

(1) The north-western mountain mass, which in places rises above 6,000 ft., forms the Scandinavian Peninsula, a part of Finland, and parts of the British Isles. There are no long chains : the system is formed of irregular mountain groups. The Scandinavian group is similar to the highlands of Scotland and the mountains of north-west Ireland, but it is higher. The western edge is deeply indented by fiords in Norway (sea-lochs in Scotland), and fringed with islands.

(2) The great European plain, stretching from England right across the continent to the Urals, and beyond these hills the lowlands continue across Asia. The European plain may be divided into two parts. The northern part is very flat, there being few hills over 500 ft. : this part with France forms the plain proper. Along the southern part, especially in Germany and France, we find a series of block-mountains and hills rising, sometimes, above 3,000 ft. The central plateau of France, the Rhenish Mountains, and the Harz Mountains are examples. In the east such highlands are missing, and nearly the whole of the Russian lands are plain.

(3) South of division (2), a mountain system, consisting of many ranges, forms a high belt across the continent. In many places it rises above 6,000 ft., and in the centre of the belt the Alps rise above 12,000 ft. In this system we find many mountain ranges such as the Pyrenees, the Alps, the Carpathians, the Balkan range, and the Caucasus. In the loops of the ranges lie depressions, which form plains or sea-basins, for example, the plains of the middle and lower Danube, the plain of the Po, and the basin of the Adriatic Sea.

It will be seen that in Europe the mountain systems run west and east : except in Asia this arrangement is not found in other continents. And Fig. 27 suggests a continuity of direction between European and Asiatic mountain systems (see further Part II, p. 424).

The moderating influence of the western ocean upon the climate of the continent is not stopped by mountains near the coasts, but is able to extend far inland. A strong contrast with North America results (p. 304).

The distribution of mountain and plain very often has a great influence on mankind. Mountain ranges sometimes hinder development. In early days the colonists of eastern North America (p. 296)

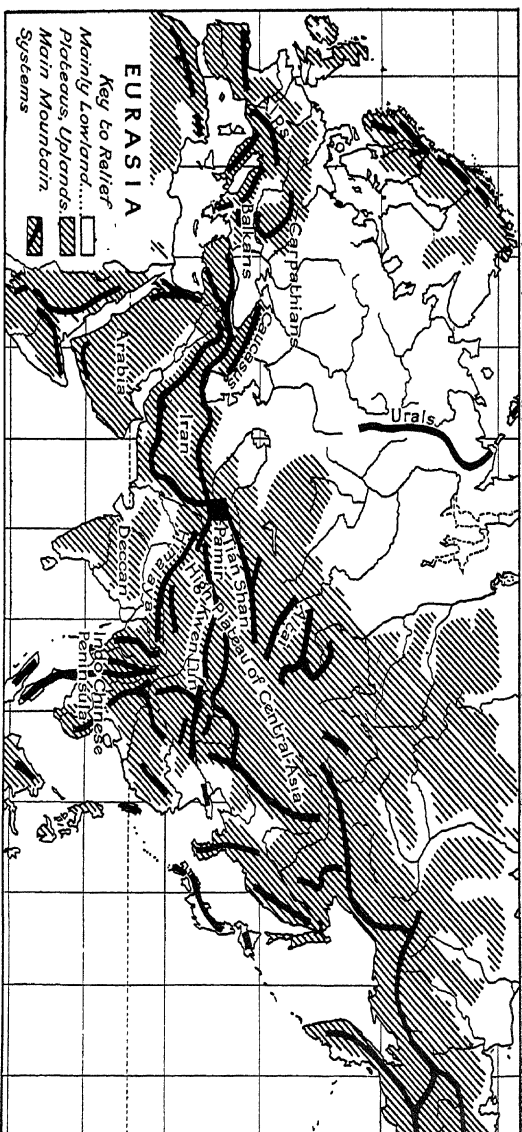


FIG. 27. (The common spellings T'ien Shan and Kwen Lun are used here; the more accurate forms T'ien Shan and Kunlun in the text.)



and Australia were hindered from exploring inland on account of mountain barriers. In Europe communication between east and west is easy, and in the south a sea route is provided by the Mediterranean. Also communications are easy between the interior of Europe and the northern, western, and south-western seas. The highlands of the centre offer few barriers because large rivers have carved their valleys across them. In the south the high Alpine system is broken up by valleys, which are connected by passes (p. 141).

In this connexion we may glance at the geological history of the building of Europe. 'Four times a great mountain range has been raised across the area which is now called Europe. Three times the mountain range has given way and portions have sunk beneath the sea, and have been covered by more recent sediments, while other portions remain standing and now rise as isolated blocks above the later beds which surround them. The last of the mountain ranges still stands and is known under the names of the Alps, the Carpathians, the Balkans, &c., but the work of destruction has already begun, and gaps have been formed by the collapse of parts of the chain. The Alps were once continuous with the Carpathians, and the Caucasus was probably connected with the Balkans across the site of the Black Sea.' In Part II (p. 427) it is considered how these wrinkles in the earth's crust are formed. Portions of the crust are subjected to stress and pressure and the parts which are less rigid are liable to give way and so crumple up into ridges.

*Rivers.*—The lowlands of north-eastern Europe are widest in Russia, so there, with one exception, the longest rivers are found. The longest, over 2,000 miles in length, is the Volga. Next comes the Danube (1,700 miles) which is not Russian. Then come five other Russian rivers (Ural, Dnieper, Kama, Don, Pechora); then the Rhine, chief river of central Europe (700 miles), two more Russian rivers (Oka and Dniester), and two more important rivers of Central Europe, Elbe and Vistula (each 600 miles). The largest river of France, the Loire, is 550 miles long : that of the Iberian peninsula, the Tagus, 600 miles, both flowing to the Atlantic. Important Mediterranean rivers are the Rhone (450 miles) and Po (350 miles).

We find that the rivers of the lowlands have broad open basins, in

contrast with the narrow basins of highland country. To give one example : the Volga basin covers more than a half a million square miles, whereas the Rhine with a third the length has an area of basin only a ninth of that of the Volga. The rivers of the highlands are faster flowing and can usually depend on good supplies of water. Such rivers can be used to supply power, by driving machinery, usually to generate electricity. In recent years, more and more use has been made of this power, especially in those countries which possess little or no coal. In the lowlands greater use can be made of rivers for navigation ; though in the eastern part of Europe ice may hinder or stop navigation in winter. In parts of the lowland regions of France and Germany we find a close network of rivers and canals.

*Climate.*—In studying the climate of Europe, there are four important factors :

- (i) the latitude,
- (ii) the open ocean to the west and the seas branching from it and penetrating the land,
- (iii) the sea lying to the south,
- (iv) the large land mass bordering on the east.

The part of the continent lying within the arctic regions is cold, but the greater part has a temperate climate. Most of it lies in the region of prevalent south-westerly winds. The Mediterranean region is not influenced by these winds for the whole year, but only for part of it. The prevailing winds over western Europe are from south-west or thereabouts, so they come over the ocean. In the British Isles we found that much of the weather ' comes from the Atlantic ' (p. 10).

The influence of the ocean and the prevailing winds are able to penetrate well inland. There is no great north-and-south range to stop them, as there is in western America ; though the Scandinavian highlands have some such effect. The warm waters and winds have the strongest influence in western Europe and least in the east. But the changes from west to east are gradual.

Eastern Europe, being far from the Atlantic Ocean, has a continental, as distinguished from an oceanic type of climate. The large land mass of Asia lying to the east shuts out any influence of the sea which might come from that direction. The Russian lands of the east get very cold winters and very hot summers, so that there is

a great range of temperature over the year. This is a contrast to the small yearly range of temperature found over the British Isles and western Europe. In eastern Europe the rainfall is not evenly distributed throughout the year, as it is in the west. In the east most of the rain falls in the summer.

From west to east—say from England to Russia—the change in temperature conditions is gradual. There is no mountain range to give a sharp climatic boundary. In Scandinavia the mountains form a boundary between Norway with western climate and Sweden with a climate almost continental. The Alps form a boundary between lands to the north and the Mediterranean region. The climate of this region ( $30^{\circ}$ – $40^{\circ}$  N. lat.) is unlike that of the rest of Europe. The greater part of this region has dry summers because the winds blow off the land, generally from some northerly direction. In the eastern part a little rain is caused in winter by the storms which arise there. We may divide the climate of the Mediterranean into ‘western’ and ‘eastern’. Both have warm wet winters and hot dry summers; but the east has as a rule colder winters and hotter summers, and less rainfall than the west.

When considering the temperature of the British Isles, we found (p. 10) that in winter the oceanic influence from the west causes the isotherms to run in a north–south direction. Now, looking at Europe (Fig. 28), we see the same effect over most of the continent, but less strongly marked, or not at all, in the east and south where the oceanic influence is weak or absent. The July (summer) map shows the isotherms running more generally from north-east to south-west. The land is warmer than the sea and the coolest parts of the land are those nearest the sea. On the temperature map for July, the isotherm of  $70^{\circ}$  F. runs roughly from west to east through the centre of Europe, and on the map for January, the isotherm of  $32^{\circ}$  F. runs nearly north to south over land. In July, the  $70^{\circ}$  line may be taken as a rough division between those lands to the north which have a cool summer and those to the south which have a warm summer. Similarly, the  $32^{\circ}$  line divides the western lands with warm winters from those of the east with cold winters. The effect of height is not taken into consideration. If the winter and summer divisions are combined on a diagram as shown in Fig. 29, we find Europe divided roughly into four quarters. In winter there is a

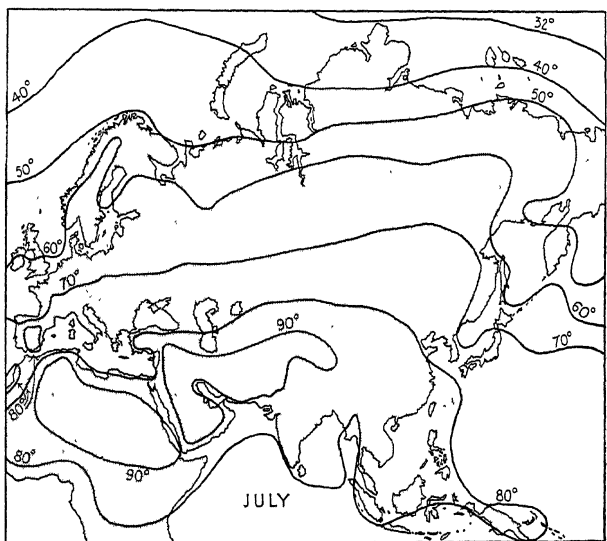
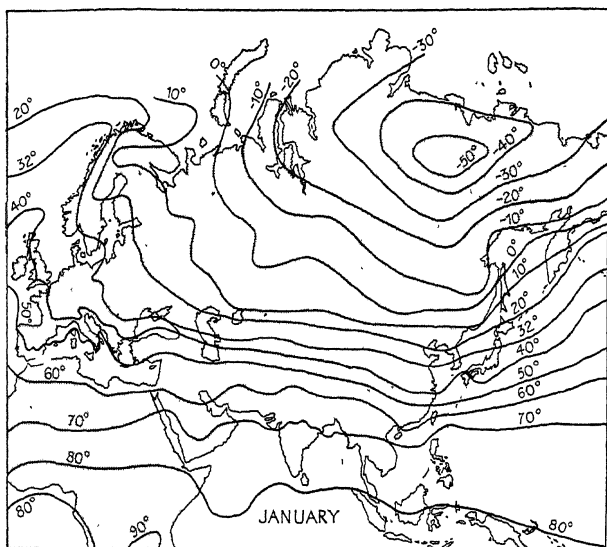


FIG. 28. ISOTHERMS (temperatures reduced to sea-level) FOR EURASIA.

general decrease of temperature from west to east. The Thames very rarely freezes, but the Rhine at Cologne is frozen for 20 days. Farther to the east, the Vistula is frozen for 60 days and the Niemen for 94 days in the year.

We have already seen why the west of Europe gets more rain than the east. If we look at a map showing mean annual rainfall, we find

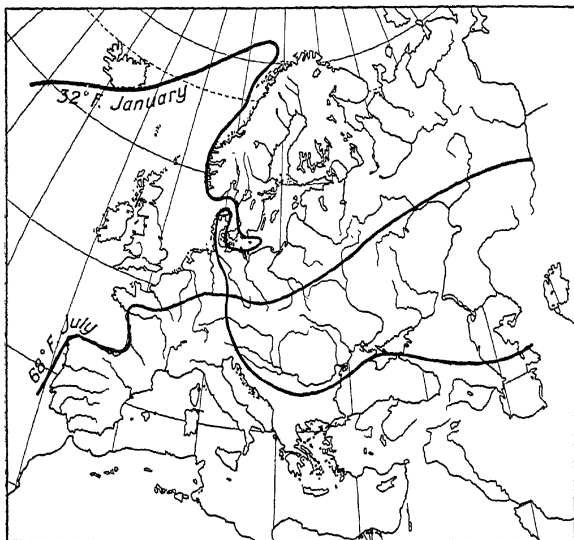


FIG. 29.

that across the plain of northern Europe there is a decrease from over 40 in. in the west of Ireland to less than 10 in. near the Urals. It is not sufficient, however, to know the mean annual rainfall ; we must know at what seasons of the year the rain falls. If we leave out complications due to differences in height, we can show the distribution of rainfall by means of diagrams. Four of these (Fig. 31) are shown to represent the winter, spring, summer, and autumn. It will be seen that for the first six months of the year the eastern part of Europe is dry. This does not mean that there is no rainfall. On the higher ground there may be fairly good rainfall, but on the plains

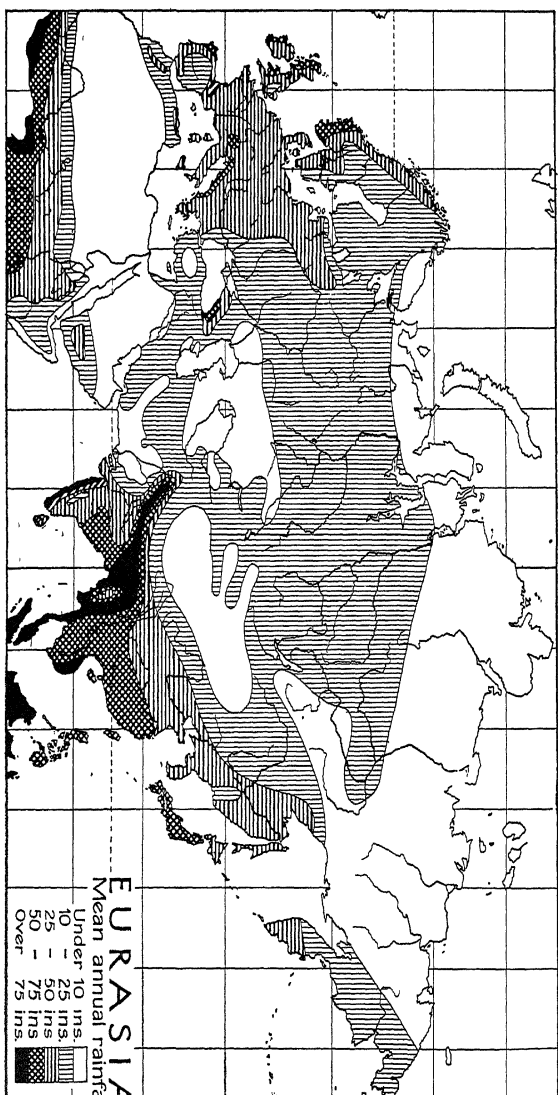


FIG. 30.

## Europe : The Continent

there is very little. In April the area which gets rain is gradually extending in towards the centre, and by July the greater part of Europe gets some rainfall. The part of Europe south of  $40^{\circ}$  N. lat., which we have called the Mediterranean region, gets practically no rain at this season, unless with thunderstorms. The reverse process

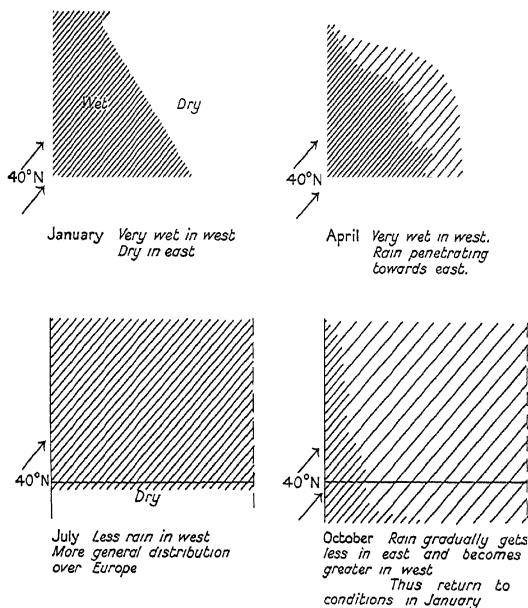


FIG. 31. DIAGRAMS OF SEASONAL RAINFALL AND WINDS OVER EUROPE.

now takes place. As winter approaches, the east of Europe gets less rain and the west has more. These diagrams, by themselves, are not sufficient to explain the distribution of rainfall over Europe, but should be used in conjunction with rainfall maps.

*Climatic Regions.*—Taking into consideration the differences in the distribution of rainfall and of temperature we can divide Europe broadly into three climatic regions :

- (i) Western Europe, with equable temperature (not very hot summers ; not very cold winters) and rain at all seasons.

(ii) Eastern Europe, with hot summers, cold winters, and rain chiefly in summer.

(iii) The Mediterranean region with hot summers, mild winters, and rain chiefly in winter.

As one passes across Europe, from north to south, or from east to

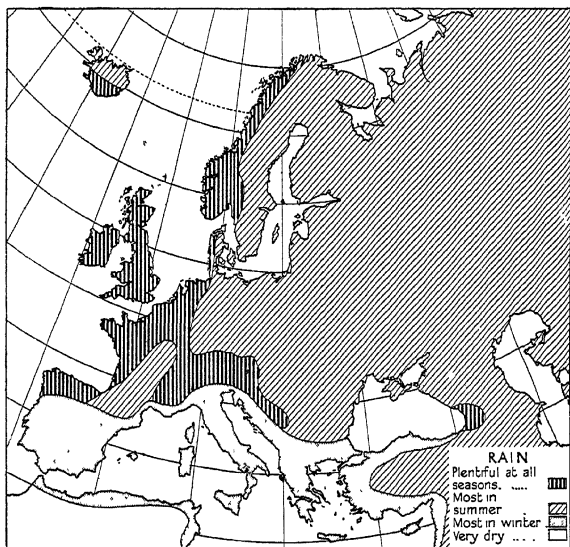


FIG. 32. SEASONAL RAINFALL IN EUROPE. (This map shows the seasons when most rain falls. The amount of rainfall may vary greatly in different parts of the divisions shown.)

west, the climatic conditions are found to change gradually, as those of one region, affected by one set of factors, merge gradually into those of another, affected by another set of factors. On a map these divisions must be shown by lines, but they are not really sharply divided.

*Vegetation.*—If we travel from the Mediterranean to the Arctic we see successive types of vegetation. If we travel (say) in the Alps, from the foot to the summit we also see successive types of vegetation.



In many parts of Europe, particularly toward the west, the natural vegetation has been greatly altered by the hand of man. Much forest has been cut down, as we found in the British Isles, to make land fit for agriculture and for the use of the wood. In Russia the vegetation is still found in the more natural state, and it is possible to make divisions according to the nature of the climate and the character of the soil.

*Tundra*.—This borders on the Arctic Ocean and to the west is found on the higher part of the Scandinavian highlands. The tundra proper, however, is low-lying, bleak, and often marshy. The plants consist of mosses, lichens, and a few dwarfed trees such as the willow and the birch. During the summer, when there is no darkness, beautiful flowering plants grow. Summer dwellers on the tundra (Lapps, Samoyeds, &c.) hunt animals for fur, and fish, and keep herds of reindeer, which give them transport, milk, flesh, and clothing. 'Tundra' is a word of Siberian origin for these Arctic lowlands, but it is used in geography of any land where such conditions of vegetation &c. are found, and we shall meet it not only in Russian Asia but also in North America and elsewhere.

*Taiga*.—South of the tundra, the heights of the trees increase and they become more numerous until real forests, called taiga, appear. They are the northern coniferous forests which extend south to the southern end of the Urals. Like the tundra, these forests also form a world-belt, and the Russian (Siberian) word 'taiga' is sometimes used generally of them, though less commonly than 'tundra' in its connexion. Pine, fir, spruce, and larch, together with birch and aspen, are characteristic trees. Forest industries are timber-cutting or lumbering, which leads to many kinds of manufacture in wood, such as match-making, furniture-making, and wooden ship-building, with wood-pulp manufacturing and charcoal-burning. The timber trade and manufactures have developed most fully in Scandinavia and Finland, where there are many rivers which provide transport and give power to saw-mills; and the forests are not far from the sea, so that export is easy.

*The Cool Temperate Belt* extends in the west from the south of Scandinavia to northern Spain. Eastward it gradually narrows, until in south-eastern Europe, under the extreme climatic conditions there, its place is taken by steppes. Forests, composed of

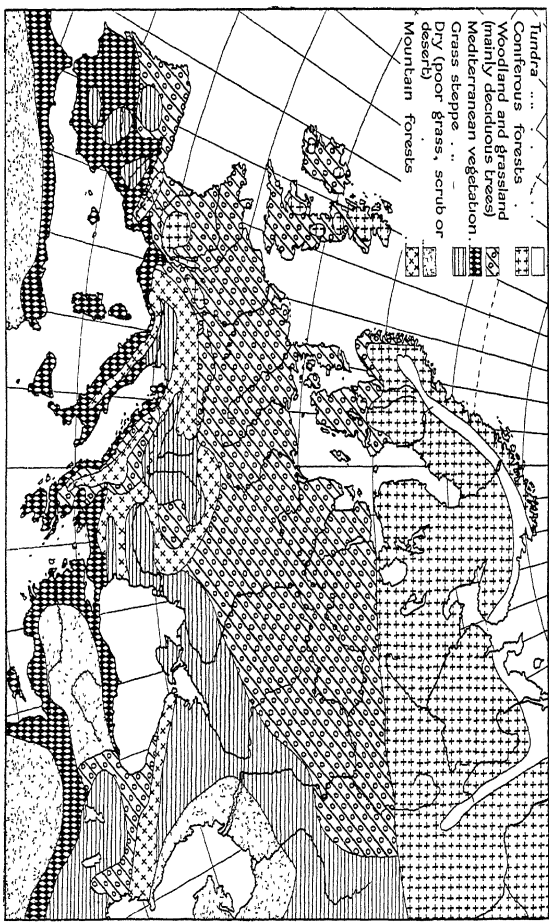


FIG. 33. NATURAL VEGETATION OF EUROPE.

such deciduous trees as oaks, beeches, elms, ash, poplars, and others well known in the British Isles, formerly covered great parts of this belt, and there still are extensive woods. But to make room for a numerous, prosperous, civilized population, much forest has been cut down. The lowland, from northern France eastward and south of the Baltic Sea, has great tracts of moorland covered with heather and peat-bogs, with some fir-woods. Much of the soil is sandy or composed of gravel, and much marsh is found over the glaciated lowlands, especially in Russia.

The Alps, excepting the lower southern slopes which fall within the Mediterranean zone, the Carpathians, and the highlands west and north of them, are within the cool temperate belt. The vegetation includes :

- (a) At the base, deciduous trees.
- (b) Higher up, coniferous trees.
- (c) Higher still, treeless tracts of meadow-land with alpine flowering plants.
- (d) Highest, below snow-line, lichens and moss.

These divisions, according to height correspond closely to the divisions according to latitude.

On the northern slopes of the Alps cultivation of fields is found up to 4,000 ft., but on the southern slopes, higher.

*Mediterranean Region.*—Under the peculiar climatic conditions of this region, especially the dry, hot summers, the trees and plants have special characters which we shall consider when we come to the region itself. Evergreens are common, and in parts of the region we find an approach to tropical types (p. 169).

*Steppes* (a Russian word meaning waste).—These are grasslands, lowlying and treeless. The extreme climate and poor rainfall prevent the growth of trees. The grass is green during the early summer, when some rain falls, but is parched to hay by the heat of the later summer. Many bulb-plants, which can store water, flower beautifully in spring. The fine loam and other soils are generally very fertile, as especially the black earth of the south Russian lands and the lower Danube plain in Rumania. Where there is sufficient rain during the growing season, or where they can be irrigated, the steppes bear rich crops of wheat and other grains.

Near the Caspian Sea, in the extreme south-east of Europe, the

steppe changes to desert. This is due to lack of rainfall and also to the fact that the soil is saline. The Caspian and Black Seas had formerly a greater extent. The parts from which the sea has retreated now form salt deserts.

Farther to the west there are grass-lands which get better rainfall than the steppes proper ; but the amount is insufficient to support forests. They are sheltered from heavy rainfall by high mountains and they get fairly great extremes of heat and cold. Such are the middle plain of the Danube, the lowland plain of northern Italy, and the smaller lowland of the Ebro basin in Spain.

Of economic plants wheat is by far the most important in Europe. Broadly speaking, it can be grown in almost any part of the continent except towards the north, where the temperature is too low and the summer too short. It does not grow north of 65° N. in Scandinavia and 60° N. in Russia. The wettest parts are unsuitable because wheat does not stand too much moisture (cf. p. 34). Barley and oats, being hardier cereals, can be grown farther north, and rye also has a wider distribution than wheat.

The time of growing wheat has to be adjusted to the varying climatic conditions. Thus in the Mediterranean region it grows during springtime and is reaped in May or June, whereas in the British Isles and in similar latitudes growth takes place more slowly and the harvest is during August.

Maize, which requires higher summer temperatures and more water than wheat, is a product of the warm temperate zone. The northern limit, in Europe, is along a line running from the south of Brittany north-eastward to Posen where the line bends to the south-east and includes Rumania and southern Russia. The vine has very much the same limit as maize, except that in the east the severe winter brings it south of the Carpathians ; also it can bear summer drought which maize cannot.

In dividing any continent into natural regions, we make use of the great climatic and vegetation divisions, which in the case of Europe have been described. In addition, we must take into consideration the relief of the land, and a distinction must be made between lowland and upland or mountain. Such division points the way to the study of the several political states into which Europe is divided.

*Political Geography.*—In Europe the political boundaries, where

they follow mountains or upland regions of sparse population, afford fairly close lines of separation between one nation and another. When they pass through populous areas, as for example along large rivers, or through lowlands, where men can move easily, this is not always the case, for people of different nationalities become easily mingled. Thus the French in France are fairly clearly marked off

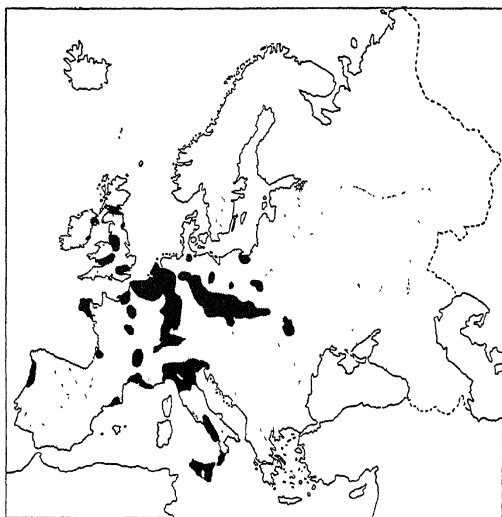


FIG. 34. The parts of Europe where the population is densest (shown in black), and scantiest (in white). For comparison with physical and regional maps. (The adjacent parts of Asia and Africa may be filled in from Figs. 62 and 85.)

from the Spaniards in Spain and the Italians in Italy by mountain frontiers ; similarly from the Swiss in Switzerland (though many of these speak French), but less clearly from the Germans and Belgians along the boundary which follows the river Rhine and the populous lowland to the north-west. The division between nations, however, was on the whole made more closely after the war of 1914-18 than before it. The large countries of Central Europe, namely Germany, Austria, and Hungary, lost territory, and the states of Poland, Czecho-Slovakia, and Yugoslavia came into being. Poland, the home of the Poles, was formerly divided between Germany and

Russia, and Czecho-Slovakia was part of Austria-Hungary (the Czechs and Slovaks are kindred people, but are neither Austrians nor Hungarians). It is important to notice how physical features have influenced the division of Europe into states. Because of its plain territory and easy communications, Prussia was able to become the most powerful German state and the King of Prussia became the German Emperor over the smaller states of the central highlands, until the empire became a republic.

In the east, one great state, namely Russia, established itself. Here there are no natural boundaries strong enough to establish independence within them, so long as there was a strong central government able to control the whole plain. But when Russia was broken by revolution, several of the peoples who were within the empire formed new and smaller states. Four such states border the Baltic Sea, each holding a section of the east coast, a port or two, and a stretch of territory behind them. From north to south, these peoples and states are the Finns of Finland, the Ests of Estonia, the Letts of Latvia, and the Lithuanians of Lithuania. To the west of the last-named state, there is a strip of territory belonging to Germany.

The port of Danzig is a free city. This was a German city and when Poland gained independence this port was given neither to Germany nor to Poland, because it was inhabited by both Germans and Poles.

The boundaries between peoples in the Danube basin are not easily defined, and though Hungary possesses most of the middle plain of the Danube, and Rumania the lower, the boundary does not follow the Transylvanian Mountains which separate the plains. Instead, the states of Rumania, Hungary, and Yugoslavia meet in the middle plain. Bulgaria lies south of the lower Danube, but does not reach the Aegean coast, and when we come to study the Balkan and Mediterranean states we shall find reasons why the political divisions between Bulgaria, Greece, Albania, and Yugoslavia have been difficult to define. On the other hand, Italy is separated from central Europe by the Alps, and this mountain system embraces also in Switzerland the best example of an independent mountain-state. The Pyrenees cut off the Iberian peninsula from France, and the barrier has been so effective that in some ways the peninsula (which is divided between Spain and Portugal) has closer relations with Africa than with Europe.

Norway and Sweden were long united under one king but the conditions of life in each country are so far different that they are separated into two kingdoms. The barren highlands which form the backbone of the peninsula are a natural barrier. The Norwegians are largely a seafaring people, while the Swedes are in greater proportion farmers and manufacturers. The Danes are of the same race as these other two peoples, but a water frontier separates them, and Denmark is a separate state.

*Transcontinental Railway Routes.*—The diagram here (Fig. 35) illustrates a few through railway routes in western and central Europe, which carry the most important international traffic. The diagram is intended as a key to a map from which the relation of these routes to main physical features may be learned ; with these clear in mind, the facts about communications in the sections on the European countries in following chapters, will be more easily related to the general scheme. The northern of the great west-east routes, through Hanover and Berlin, is joined in the neighbourhood of Hanover by lines from all the chief North Sea ports south of Hamburg, and also by the route from Paris which follows the valley of the river Meuse by Namur, in order to pass through the hill-country of the Ardennes and reach Cologne. The route to the east, through Berlin and onward to Moscow, crosses the north European plain, and from Moscow, which is a converging-point for railways from all parts of Russia, it is continued eastward into Asia, and completes, with the Trans-Siberian railway (p. 220), the only Eurasian transcontinental line.

There should next be traced the routes southward from Hanover and Berlin through Leipzig and Dresden, contrasting that through Leipzig which runs high over the central uplands with that through Dresden which follows the valley of the Elbe. The line Cologne-Frankfurt-Regensburg-Vienna marks part of an important diagonal route from north-west to south-east : from the Rhine valley at Mainz it follows the valley of the Main, and crosses a depression through the hills of the Franconian Jura in order to reach the upper Danube, the general direction of which it follows to Vienna, but not the valley of the river itself all the way, for that is in parts narrow and difficult. A second important west-east route is that from Paris, which follows a depression north of the Vosges Mountains in order

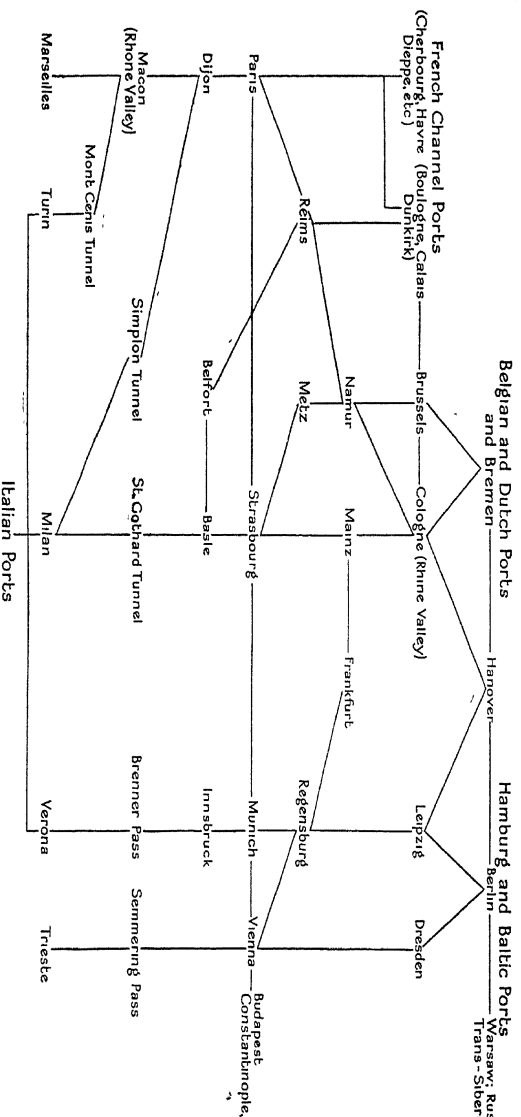


Fig. 35. Diagram of chief transcontinental railways in western and central Europe.



to reach the Rhine at Strasbourg, then turns the northern slopes of the Black Forest, and crosses the central uplands to Munich, and so to the Danube route and Vienna.

When tracing the north-south routes through Paris and through Cologne, attention should be given to the outstanding importance of the Rhine and Rhone valleys. The five principal Alpine tunnels and passes—Mont Cenis, Simplon, and St. Gothard tunnels, Brenner and Semmering passes, are seen on the diagram. Lastly we should trace (beyond the limits of the diagram) the continuation of the 'Orient' route from Vienna, which crosses the middle plain of the Danube, and penetrates the mountainous Balkan country by the valleys of the Morava and Maritsa, to reach Constantinople on the strait of the Bosphorus facing Asia Minor. The connexions of all these southern routes with the Mediterranean countries will appear in the chapter on those lands.

## IV. EUROPE : WEST, NORTH, AND EAST

### FRANCE

*Regional View.*—A large part of France belongs to the European plain, though all this lowland is not flat. There are four hilly regions in addition to the high mountain masses of the Alps and the Pyrenees which border on the south-east and south respectively. These are the central plateau, Brittany and adjacent lands in the north-west, the Ardennes in the north-east, and the Vosges Mountains in the east. The Paris basin is part of the European plain proper and is surrounded by low hills. In the south-west there is lowland in the valleys of the Garonne and the Loire, and in the east France extends, in Alsace, to the middle valley of the Rhine.

Owing to variations in climate and differences in soil, these different divisions of France have peculiarities of their own. The average winter temperature varies from  $35^{\circ}$  F. in the east to  $40^{\circ}$  F. in the west, and the summer range is from  $64^{\circ}$  F. in the north to over  $70^{\circ}$  F. in the south. Except over Mediterranean France the rainfall varies according to the position of the mountains. The central plateau reaches its greatest height in the south and east. In the north-west the average height is 1,800 ft., but Mont Lozère in the Cevennes is over 5,500 ft. In the more exposed parts the annual rainfall is over 60 inches. The plateau is composed chiefly of archæan (old) rocks yielding unfertile soil. The country is in part not unlike Dartmoor, for large blocks of granite, like tors (p. 27), are scattered about and it is covered with heather, moors, and scanty woods. The valleys are deeply cut and mostly narrow, but two of the rivers, the Allier and the Loire, have broader and richer valleys : that of the Allier is the most fertile district in France. In the valleys and more sheltered districts wheat and oats are grown, but the characteristic crop of the plateau is rye. The plateau is better suited to pastoral farming, and one-fifth of the sheep and cattle of France are reared here. Standing on the plateau are many extinct volcanoes in the form of cones.

At the southern end of the plateau is found a limestone district, the most barren in France. The French call such a district Causse

(*calx*, lime). Where the rivers have cut down their narrow valleys to the beds of clay beneath, the floors of the valleys have luxuriant vegetation.

Toward the eastern edge of the plateau there are a number of coal-fields, four of which are important, though not large, nor is the coal of good quality. The northern coal-field is at Autun ; farther south is Creuzot ; the largest is around St. Etienne, and in the south-east lies Alais. Iron-ore is also found in this region, especially around Morvan, and although it is found chiefly away from the coal-fields and in comparatively small quantities, it has helped in the development of a steel industry. Creuzot, St. Etienne, and other towns produce iron and steel goods, and the best French steel comes from this district. Textile industries are carried on in a few of the towns. The most important is the manufacture of silk goods (ribbons) at St. Etienne. At Roanne, in the basin of the Allier, cotton and woollen goods are manufactured. Limoges is famous for the manufacture of china. Thiers is noted for its cutlery and Vichy for mineral-waters.

*Brittany* and its neighbourhood form a division consisting of two hill-ranges running from west to east, converging on the coast, and separating three lowland districts—one along the north coast, one in the centre, and one along the south coast. In the uplands the soil is poor, but in the lowlands, especially near the coast, it is good. Here again the rocks are old, and similar to those of south-western England. The coastal lands are well cultivated and in the north market-gardening is important. Farther east in the basin of Rennes and around the lower Loire there is more arable farming, an important crop being wheat. The hills of Brittany receive a good supply of rain from the westerly winds, and in consequence the higher parts are fairly wooded; but there are large stretches of excellent pastures. The moist climate is suitable for cattle-rearing and this region has one-fifth of the cattle of France. The conditions are not so suitable for sheep but a fair number are kept.

There are few large towns in this division because the industries are not of a kind to support large populations. There are few manufactures. Laval and Nantes have textile industries and Nantes is engaged in the leather industry. Many people are engaged in the fishing industry and Breton fishermen go to the fishing banks of

Newfoundland (p. 315). The 'ria' type of coast provides good harbours, and we find the principal naval stations, Cherbourg, Brest, and Lorient, along this coast. Nantes and St. Nazaire are important,

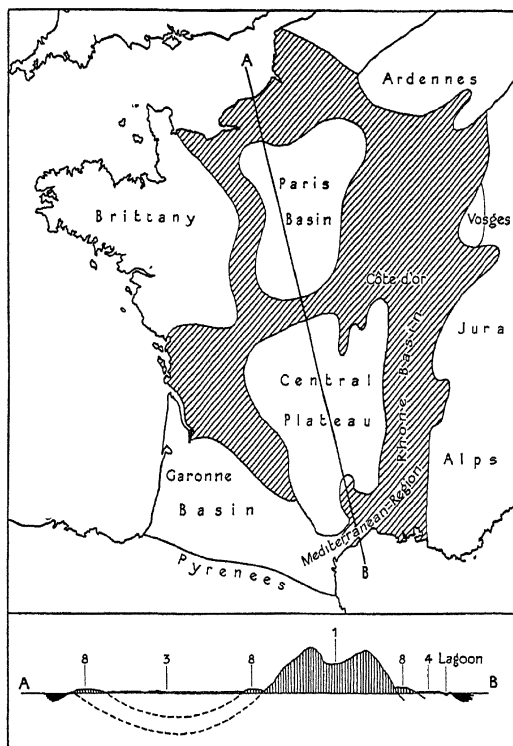


FIG. 36. NATURAL DIVISIONS OF FRANCE. In the section along the line A B in the map, (1) indicates the central plateau, (3) the Paris basin, (4) the Mediterranean region, (8) hilly country surrounding Paris basin and bordering central plateau.

but most of the ports along this coast are so far from the industrial regions that they have little trade. Cherbourg in Normandy, however, situated on a peninsula which projects like a natural pier into the English Channel, is a port of call for big liners, principally to and from North America.

*The South-West.*—The lowland division of the south-west is enclosed by the upland of Brittany, the Central Plateau, and the Pyrenees. In places the soil is unfertile. In the east the limestone makes barren ground, in the Landes district it is sandy, and towards the Pyrenees there are rocky tracts with thin soil. The most fertile country is found in the basins of the rivers, especially in the valley of the Garonne. Most of the people here are engaged in some form of agriculture. Wheat is grown, but a more important crop is maize. Nearly the whole of the French maize crop is obtained here, as the temperature and rainfall are both suitable for its production. On the drier soils, as in the Landes and on the Pyrenean slopes, sheep are reared, while cattle graze on the richer pastures. Something like one-third of the vineyards of France are found in this region. The chief centre is Bordeaux which collects the produce of the country around.

From the districts behind Bordeaux come such well-known wines as Sauterne, St. Julien, and Médoc. Farther north, in the Charente valley, a brandy-distilling industry is established. The chief town is Cognac. There are no minerals in this region, but coal can be obtained fairly easily from Great Britain. The important towns are the ports where the agricultural products are prepared and exported to foreign markets. Bordeaux has sugar refineries and chemical works. Bayonne, where there are iron-works, and Pauillac, the out-port of Bordeaux, are other important towns.

*The Mediterranean Coastal Belt* in France shows the characteristic vegetation of the Mediterranean region (p. 165). Much of the land near the coast is poor, but farther inland the soil is good. Practically all the olive-yards in France, and over half the mulberry trees and one-third of the vines, are found in this division.

The narrow Rhone valley forms a most important district. It has not the Mediterranean type of climate, but the vine and the mulberry grow well. The olive, a tree requiring rain in winter only, does not grow up the valley. One-half of the mulberry trees and one-ninth of the vineyards of France are found in the Rhone valley.

The valley provides an important north-south route for France, and connects France with Africa and other Mediterranean countries. The nearness of the coal-deposits of the central plateau has been an important factor in the industrial development of this district. The

manufacture of silk has naturally developed in a region where the mulberry grows easily, for silk-worms are fed upon its leaves ; but the local supply of raw material is insufficient and large quantities are obtained from Italy, China, and Japan. Spinning is found all along the valley, but weaving is centred at Lyons. In recent years more and more use has been made of water-power, which generates

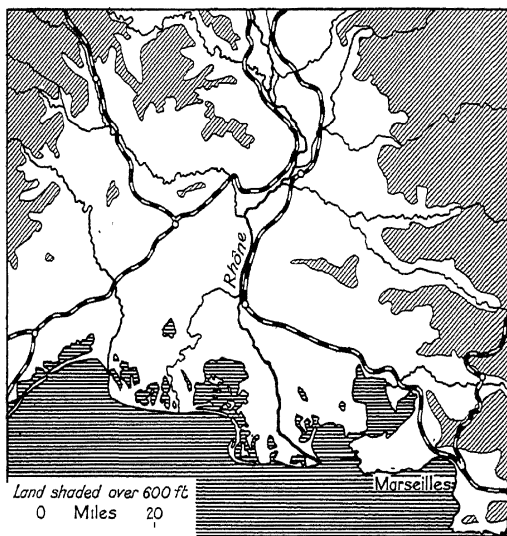


FIG. 37. THE POSITION OF MARSEILLES in its relation to the Rhone delta.

electricity, and this is used for driving the machinery in the silk mills. This power is derived from the Rhone at Lyons and from the Loire at St. Etienne. Marseilles is one of the most important towns of France. It does not stand at the mouth of the Rhone because this river has a delta, but on a bay to the east, and it is connected with the Rhone by a canal. The cultivation of olives led to the manufacture here of olive oil, and later to the manufacture of other oils, candles, and soap. Such articles as linseed, ground nuts, and copra can be imported easily. The presence of coal along the plateau and the necessity for silk-weaving machinery

has given rise to a large engineering industry at Lyons, which is also famous for its motor-car works. Marseilles, being a great port, can easily import coal and iron, and is a centre for smelting, ship-building, and engineering works.

To the east of the Rhone valley only the Riviera, the beautiful coastal margin of the Mediterranean, has many large towns, which prosper by their visitors from other countries. In the Alpine division the country is only thinly populated. Except in the valleys the soil is poor, and difficult to cultivate on the steep mountain-slopes. In the valleys the vine is cultivated, and cattle, sheep, and goats are fed on the pastures. The valley of the Isère is important because water-power can be used there. Grenoble is the centre of a glove-making district.

*The Paris Basin* proper is not extensive, but the name is commonly applied to the whole area between the central plateau, the Ardennes, and Brittany. Much of it is hilly and in many places the soil is unfertile, but as a whole it is the most important agricultural division of France. The climatic conditions are not unlike those of eastern England and wheat is the chief crop. Another large crop is oats. Market-gardening is important, especially (as usual) in the vicinity of large towns. To the north-east, in the provinces of Artois and Picardy, sugar-beet and flax are grown. There are two separate vine-growing districts in the Paris basin—that of the middle Loire, and that of the eastern part of the Seine basin. In the east the two more important tributaries are the Aisne and Marne. Here the vines, from which champagne is made, grow on the east-facing limestone and chalk slopes. In the Loire basin light wines are made. Farther to the south-east lies another vine-growing region, the Saône valley, which produces Burgundy, but this is outside the Paris Basin proper. The vines grow on the eastern slopes of the Côte d'Or.

The Paris basin is also the most important industrial division of France. In the departments of the Nord and the Pas-de-Calais lies a part of the great coal-field which stretches from western Germany through Belgium to France. In the French part of the coal-field, the coal seams lie deeper than in Belgium and the coal is more costly to produce. During the war of 1914-18 much damage was done to these mines, and as compensation, and in order that France might carry on its manufactures, the coal of the Saar basin was handed

over by Germany. An important steel industry developed on the northern coal-field to supply the various engineering and textile works around Lille and Valenciennes. The steel industry is centred at Nancy and Longwy.

There are two districts where cotton-manufacturing is carried on—one with its centre at Lille on the coal-field and the other with its

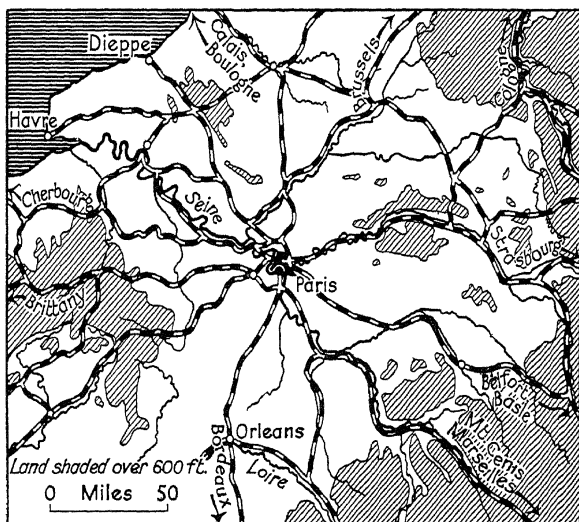


FIG. 38. PARIS IN ITS BASIN, with main railway routes to the Channel Coast and through the surrounding hills.

centre at Rouen on the Seine in Normandy. The growth of the industry in Rouen was due in the first place to the fact that the raw cotton was imported from North America through Rouen. On the coal-field, Lille is important for spinning and St. Quentin and Amiens for weaving.

Raw wool is imported from abroad through Dunkirk, and the towns of Roubaix, Tourcoing, and Fourmies are engaged in the woollen industry. In the hilly districts (like downs) surrounding the Paris basin, where sheep are reared, there are other centres engaged in the manufacture of woollen goods. The chief are Reims in the



Champagne district, Orleans in the Loire basin, and Elbeuf and Louviers in Normandy. Paris, the capital of France, lies in the centre of the basin away from the supplies of coal and raw materials ; but it is an easy meeting-place of land-communications, and has a fine waterway to the sea in the river Seine. It manufactures articles of little bulk but of considerable value, such as gloves, millinery, and jewellery. Sèvres is famous for its porcelain.

*The East.*—On the eastern border of France are the two highland districts of the Ardennes and the Vosges ; with hilly country between, in Lorraine. The easternmost part of the boundary reaches the Rhine in Alsace. The iron-ore fields of Lorraine have already been noted, and in addition there are considerable deposits of potash and salt. Alsace, in the basin of the Ill, a western tributary of the Rhine, is distinctly agricultural country, which produces vines, hops, rye, and wheat. To the north of Mulhouse there are valuable potash deposits. The Rhine, like certain other rivers of Europe, has been made an international river, and is controlled by a Commission. It is commonly held that a river which flows through a populous valley does not make a good international boundary, because it separates people whose industries and interests, broadly speaking, are the same. The Rhine is a good example. The river, however, is open to vessels of any nationality, and there is a neutral zone along each bank of the river.

*Occupations.*—The population of France has not increased in modern times like those of great manufacturing countries like England. France is an agricultural country ; it contains an abundance of fertile land and can produce a variety of crops. The area which produces wheat is more than eight times the size of the area producing wheat in Britain, but the yield per acre is lower. The most valuable of the agricultural products is the vine, which grows best on sunny slopes and in sheltered valleys. It is only in the north and north-west that the climate is unsuitable for its growth. There are few towns in France with a population of over 200,000. In Britain and Germany there are many such towns. France has little coal and until recent times had comparatively little iron-ore, so that less than 10 per cent. of the population are engaged in manufacturing industries, whereas over 40 per cent. are engaged in agriculture.

*Communications.*—In the lowlands of the north of France, where

the building of railways has been easy, there are routes radiating in all directions from Paris. These connect northward with the Channel ports such as Dunkirk, Calais, Boulogne, Dieppe, Havre, and Cherbourg. For the rest, the following natural main lines of communication, and their importance in relation to railway routes, should be studied in the atlas : (1) the route by the Meuse valley into Belgium ; (2) the routes into Alsace by the gaps north and south of the Vosges, at Saverne (for Strasbourg) and Belfort (for Basle) respectively ; (3) the connexion across the Côte d'Or, between the Paris basin, Dijon, and the Rhone valley, which is the main line of communication to the south (Mediterranean) coast ; (4) the lines branching eastward from this through the Alpine region to Switzerland and Italy (p. 97) ; (5) the communications south-westward from Paris, across the low divide to the Loire valley, and through the gap of Poitou, near Poitiers, to the basin of the Garonne.

The four big river systems lie in such a position that by means of connecting canals the rivers can be used a great deal for inland navigation. They are especially important in the north-east and east where the system is connected with those of Belgium and Germany. The chief canals are : (1) the Oise connexions with the Meuse, the Sambre, and the Schelde ; (2) the Marne-Rhine canal which uses the gap at Saverne ; (3) the Burgundy canal which joins the Saône and Yonne ; (4) the Canal du Centre which joins the Saône and Loire ; (5) the Rhone-Rhine canal which passes through the gap at Belfort ; (6) the Canal du Midi which connects the Garonne and Rhone by way of the gap at Carcassonne between the central plateau and the Pyrenees.

The Seine is navigable by small ocean-going steamers as far as Rouen, and smaller vessels go right up to Paris. On the Rhone the strong current makes it difficult to ascend the river ; nevertheless it carries a considerable barge traffic, which has access to Marseilles by a canal from the delta of the river, passing through a tunnel under the ridge between the port and the lagoon called the Étang de Berre. The waterways of France carry something like 20 per cent. of the total tonnage of merchandise, and most of the goods carried are of the bulky kind ; such as coal, coke, charcoal, and agricultural produce. Water transport is considerably cheaper, but rail transport is much quicker.

France occupies a very good position for sea-borne commerce having coastlines upon the Atlantic Ocean, the English Channel, and the Mediterranean Sea. Marseilles deals with most of the trade with the Mediterranean and the East ; Rouen and Havre are the chief ports for trade with Great Britain and North America ; Dunkirk is growing rapidly and imports wool from South America ; and Bordeaux exports large quantities of wine, and trades with Africa and South America especially. The chief imports are coal and raw materials, especially silk and cotton. In addition to wine, the exports consist chiefly of textile goods, of which silk goods are the most important. Unlike other manufacturing countries of Europe, France does not import any large quantities of food stuffs.

#### BELGIUM AND LUXEMBOURG

A large part of Belgium is lowland ; some of it is below sea-level. The south-eastern region (i. e. south of the Sambre valley), which in places has an elevation of 2,000 ft., belongs to the Ardennes plateau. The central part of Belgium is a continuation of the northern plain of France, but the soils vary considerably in this region.

The climate is warm in summer and mild in winter, except in the Ardennes where it is more severe. In summer the mean temperature (65° F.) is roughly the same as that of London, but in winter it is a few degrees lower (35° F.). Being farther from the Atlantic, rain is not evenly distributed throughout the year, but falls chiefly in summer and autumn. It varies in different districts from 20 to 40 inches.

The coastline is very low, and along it stretch lines of sand-dunes, built up by sea and wind. Inside the dunes is a belt of marshes, covered with water, and known as *wadden*. In places along the coast embankments have to be built to keep back the sea. Parts of the *wadden* have been artificially drained and are used for dairy-farming. From these the land rises gradually to the plain of Belgium. Here the soils are made up of alluvial deposits, sand, gravel, and loam, and are in some places—for example in Hesbaye, Brabant, and Hainaut, very fertile. But in the north-east, in Antwerp and Limburg, where the *wadden* gives place to a district called the ' Campine ' (a sandy

tract) it is very unfertile. Most of this land was covered with barren heath, but now much of it yields pasture. The Campine ends against the Ardennes.

The plain in central Belgium, which continues the north-eastern plain of France, yields much the same agricultural products, namely, wheat, sugar-beet, and flax. But owing to the slightly colder climate, more land is given up to rye and oats than to wheat. The upland region of the south-east, which borders on Luxembourg, is of little economic importance. Some sheep and cattle are reared and the chief crops are rye and oats. The valleys are more sheltered and can

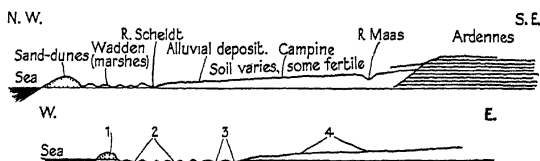


FIG. 39. The upper section is across Belgium, the lower across Holland. References to divisions in Holland: (1) Sand-dunes. (2) Marshy lands (*wadden*) below sea-level. (3) Drained lands (*polders*). (4) *Geest* lands (largely barren).

produce better crops. The vine is cultivated in the Meuse valley. The independent state of Luxembourg, with an area of nearly a thousand square miles, has a scattered population of only 264,000. Owing to its elevation it has a bleak climate and, like south-eastern Belgium, it has little agricultural wealth. It is rich in iron-ore. The capital is Luxembourg.

*Population and Industry.*—Belgium has a large population for its small area and averages over 650 persons to the square mile. It is inhabited by two different peoples—Flemings in the north, rather tall and fair, whose language is like Dutch, and Walloons, shorter and darker, in the south, who speak a kind of French. The production of coal is great in relation to the size of the country, and in addition there are valuable deposits of other minerals. The chief deposits of coal are found along a belt bordering the highlands. In the west the coal-fields are continuous with those of France, while in the east they are connected with the Aachen coal-field in Germany. The coal-mining centres are Charleroi, Liège, Namur, and Mons. In this region there are numerous important manufacturing centres.

Many kinds of iron and steel goods are made at Charleroi, Liège, and Mons. Large quantities of iron and steel goods of the cheaper kind are exported through Antwerp on the Schelde. Heavy goods can be transported cheaply by canal and river.

A large number of people are employed in the making of glass, earthenware, and chemicals. A great woollen industry is centred at Verviers, where pure water is available for washing the wool, which is mostly imported through Antwerp. The chief agricultural

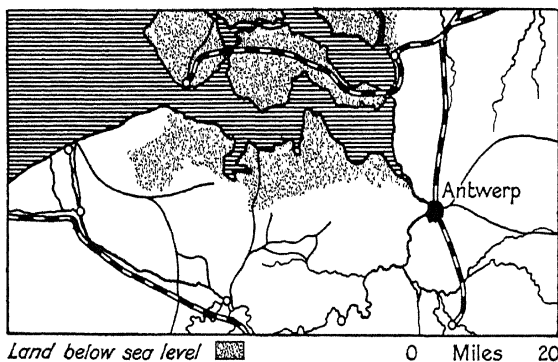


FIG. 40. THE POSITION OF ANTWERP, in relation to the Schelde estuary and other waterways.

products of central Belgium and Flanders have been referred to already ; other crops of the Campine are rye, potatoes, and tobacco, and in the drained *wadden* barley is grown. The towns of this region were famous as far back as the Middle Ages for their commerce and manufactures. The manufacture of linen is most important. The chief centres are Ghent, Courtrai, and Tournai, which lie in the flax-growing region. But home supplies of flax are insufficient to support the industry and large quantities are imported from Russia.

*Communications* in Belgium—both water and rail—are good, and this has been an important factor in the development of industries. Brussels, the capital, which stands at the junction between the plains and the hills, is the centre of the railway system. The flat lands make easy communication by rail, river, and canal. Belgium has the

greatest length of railway in proportion to area, of any country, and has also a very fine system of light (narrow-gauge) railways. Antwerp is one of the principal ports in Europe and the only natural port in Belgium. Ostend, a port for passenger traffic from England (Dover) has an artificial harbour. Ghent, Bruges, and Brussels are reached by ship-canal.

It is important to notice the position of Belgium in relation to continental routes. In addition to the connexions with France, the Belgian lines are connected with those of Germany and Holland. There are over a thousand miles of waterway which are made up chiefly by the rivers Schelde, Lys, Dendre, Sambre, and Meuse and their canal connexions. It has been necessary to canalize the greater part of these rivers in order to make them navigable. The imports of Belgium consist largely of raw materials and foodstuffs, while the exports are made up chiefly of manufactured, or partly manufactured goods. Most of Belgium's trade relations are with France, Germany, Holland, and Great Britain, but large quantities of wool are imported from the Argentine and Australia, and wheat from the United States.

#### HOLLAND

The kingdom of the Netherlands (that is, the Low Country) or Holland, as it is often called from one of its chief provinces, lies north-east of Belgium. It has a slightly larger area than Belgium, but a population considerably less (six millions). The people of the Netherlands are divided between Frisians in the west and north-west, Saxons in the east and north-east, and Franks in the south. Only one language, Dutch, is used in writing, and is spoken by well-educated people generally ; but the Frisians, Saxons, and Franks speak different dialects, live in different types of houses, and have different customs and characteristics. Holland is a piece of the European plain, being an eastward extension from Belgium, and there is no natural boundary separating it from Germany. The surface features are in many ways similar to those of Belgium. The land is even flatter than in that country, and except in the south-west (Limburg) where it rises over 1,000 ft., the elevation is very near sea-level, and at least a quarter of the country is below it.

Holland includes parts of the lower courses and the mouths of

three important rivers—the Rhine, the Meuse, and the Schelde. In the south the coast is broken by many channels enclosing islands, at the mouths of the large rivers. Farther north is a large inlet called the Zuider Sea, and outside this and the coast farther east stretches a long line of islands, separated from the mainland by shallow channels. These islands have been built up by the constructive action of the sea.

Before the thirteenth century a large part now covered by the Zuider Sea was dry land ; a great storm burst the embankment and flooded the land. By building embankments and draining portions, the Dutch are gradually reclaiming this land. The coastal features are continued from Belgium. The coast is so low that the sea would submerge much land if dykes or embankments were not built to keep it out. The marshes or fenlands inside the dunes, here called *watten*, are broader than in Belgium, and in the parts farthest from the sea, where the water is not salt, the reclaimed lands called *polders* are highly fertile. The rise inland is more gentle than in Belgium, but the soil is similar to that of the Campine (sand and gravel). This region, which has the name of *geest*, is generally unfertile and consists mostly of heath. Very few towns and villages are found here. The country may be divided into two natural divisions, chiefly according to differences in the composition of the soil. (1) The part covered by the Scandinavian ice-sheet has a soil formed of boulder-clay mixed with alluvial deposits. The water lying in hollows forms bogs and the soil is mostly dry and sandy or stony. (2) In the south-west the land is formed chiefly of alluvial deposits brought down by the rivers. Most of this land is about sea-level and much of it has been drained to form the *polders*.

The Netherlands have only a little coal and iron-ore, so that the chief wealth lies in agriculture. The cultivation and products vary according to the two divisions. In the first of these, much land is unfit for cultivation, but the rest yields potatoes, rye, buckwheat, and oats. The most fertile region, where the population is denser, is the south of Limburg, where sugar-beet and wheat are grown. The only coal-field of Holland is found here, at Kerksade, and this gives rise to some manufacturing industries. The chief are woollens, glass, and pottery making. Maastricht is the centre. The second division is the more important in every way.

It contains good grass lands as well as arable lands, and a very important industry is dairying. The famous Frisian cattle are reared here on the *polders*. Large quantities of butter and cheese are exported. In the south the most important crops are wheat and beet; those of the north are rye and oats, while flax and tobacco are also grown. The features of the country and the exposure to prevailing winds from seaward enable the Dutch to make good use of windmills for pumping water from the *polders* and grinding grain.

Along the margin of the alluvial deposits, where the *geest* begins, are found many market-gardening centres, such as Haarlem. They are famous for fruits and flowers, especially bulbs, which are exported.

The density of population in this agricultural land is closely controlled by the soil, the sandy districts and fenlands having the least population and the fertile reclaimed lands and those along great rivers the most. A large number of people live on boats. This region contains three-fifths of the total population and all the large towns. The largest towns, Amsterdam and Rotterdam, are ports, and their positions give them great importance.

The Netherlands control the outlets of the Rhine, Meuse, and Schelde; therefore the country, in addition to its own trade, has a very large transit trade, especially to and from Germany, by way of the Rhine. Amsterdam is reached by the North Sea canal which runs through the peninsula between the North and Zuider seas. Both ports are engaged in shipbuilding, and in addition there are other important industries. Many people are employed in sugar refineries, the raw sugar coming from two sources. Large quantities of cane-sugar come to Amsterdam from the Dutch East Indies (p. 232) and sugar is also extracted from the sugar-beet. Other industries are brewing, distilling, brick-making, and the manufacture of pottery, and important towns for these are Delft and The Hague. The last-named is the capital, though only a small town. The Hook of Holland, an outport for Rotterdam, has a large passenger traffic with England (Harwich), and Vlissingen (or Flushing) is also a passenger port.

Besides Delft and The Hague, another inland town is Utrecht which is important for textile goods and is also a railway centre. The communications of Holland are good, for the building of railways



or canals has been a comparatively easy task. Holland has plenty of railways, and a special feature of the communications is the use of steam tramways, which serve as feeders to the main railways.

The Rhine is the great waterway and this is connected to the Zuider Sea at Amsterdam by a canal. It is partly on account of the communications, especially by the Rhine, with industrial Germany that Holland has developed a great commerce in goods in transit ; partly also because of the trade, passing through Holland, in the products of the Dutch possessions in the Malay Archipelago (p. 232). There is a contrast here with Belgium, a stronger industrial country. In addition to the larger canals and rivers there are in Holland a great number of drainage canals used for shipping goods, especially agricultural produce. When frozen in winter, the canals allow people to get about on skates. The dykes bordering canals often have good roads along their tops.

#### GERMANY

The German republic comprises a number of states of which the largest is Prussia, the northern division, containing the capital, Berlin. The republic covers much of what is called Central Europe. Its climatic conditions are transitional between those of western and eastern Europe, but rather western than eastern in type. The average winter temperature of eastern Germany is somewhere near freezing-point, which is only 6° F. lower than that of East Anglia ; while the average summer temperature of northern Germany is similar to that of East Anglia. Naturally, however, considerable variety of climate is found in different parts because of differences in height. The north European plain is continued from Holland across northern Germany to Poland. Bordering it on the south there is highland country which stretches from the plain in the north to the Alps in the south. These uplands, part of the central highlands of Europe, have a varied topography. In the west, the rift valley of the Rhine, with a length of 700 miles and a breadth of 50 miles, is sunken between the old highland masses of the Vosges on the west and the Black Forest and Odenwald on the east. To the north of this, the Rhine cuts a deep gorge through the highlands (here about 1,600 ft. high) which extend north-eastward from the French frontier, and overlook the plain to the north. To the north

of the Danube, between the Black Forest and the Bavarian Forest, lies a broad table-land of limestone, the Swabian Jura. This table-land, which has an average height of about 2,500 ft., slopes gently down to the Danube valley. To the east lies the Bohemian frontier, an old highland region of plateaus and the ranges called the Bavarian Forest, Ore Mountains (Erzgebirge), and Sudetes, along which runs the German frontier with Bohemia (part of the republic of Czechoslovakia). The Fichtel Mountains, at the north-west corner of this highland belt, form a node from which the Thuringian Forest continues north-westward the line of the Bohemian Forest. Farther north rises the small upland region called the Harz Mountains. In south Germany the northern slopes or foreland of the Alps form a separate region.

Germany has thus three main natural divisions : (1) the north German plain ; (2) the central highlands and valleys ; (3) the Alpine foreland.

*The North German Plain.*—The same general features of the coastline are continued from Holland, the chief of which are the presence of sand-dunes and marshes (*watten*) and the sandy or gravelly nature of the soil. The coast is difficult to approach on account of the bar of islands along the coast and submerged sandbanks between them and the shore. The sand and gravel area is unfertile and covered with fir woods and heath, and the chief occupation is the keeping of sheep.

The plain is undulating rather than flat but its elevation is seldom above 600 ft. During the Ice Age the greater part of the plain was covered by an ice sheet and the land bears many traces of glacial action. A tremendous number of lakes are seen, especially in the east, and a smaller number of large lakes are found in Mecklenburg and around Berlin. There are many ridges or moraines formed where the edge of the ice-sheet rested in different positions. The soils vary considerably, but generally they are poor. The water formed from the melting ice deposited unfertile sand and gravel ; but in some places boulder clay is mixed with other deposits to form good soil. Some of the country is marshy and waste, while higher parts consist of heath and moor. On the other hand, very fertile land is found in parts of Saxony, in the middle valley of the Elbe.

To the west, again, where the lowland bends southward in Westphalia, the soil is partly formed of alluvial deposits, and here good

crops of cereals are produced and oak forests grow. Large numbers of horses, cattle, and pigs are reared here. Years of cultivation have greatly improved the soils of this lowland region, and apart from grass-land or forest there is very little land which does not produce

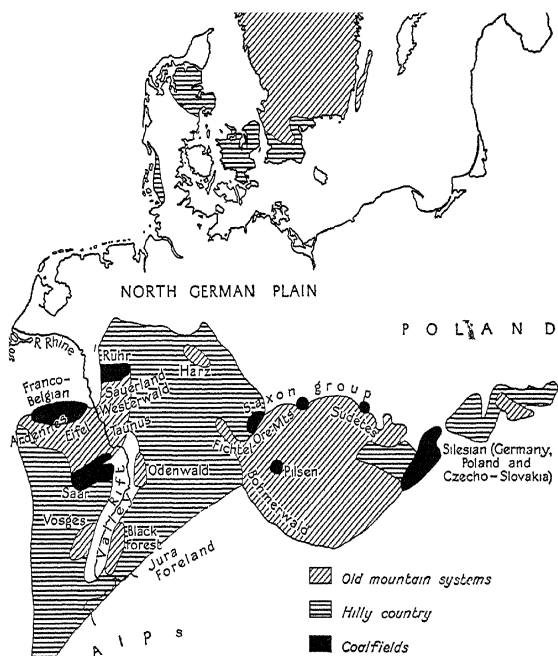


FIG. 41. NATURAL DIVISIONS OF GERMANY, WITH COAL-FIELDS.

crops of some kind. About half the plain is under crops. The climate is more severe than in France, and rye is the most important cereal and next to this come oats. Black bread is eaten in Germany. The growing of potatoes is of great importance, especially in Brandenburg. Around Magdeburg and in parts of Silesia an important crop is sugar-beet, and in the production of beet-sugar Germany leads the world. In the first place the success of the industry was

due to the granting of subsidies by the Government. This is now being done in England. Coal is mined in the neighbourhood of Strassfurt, and fertilizers are obtained from the salt deposits there. On the plain, minerals are of little importance, for they are mostly found in the upland regions.

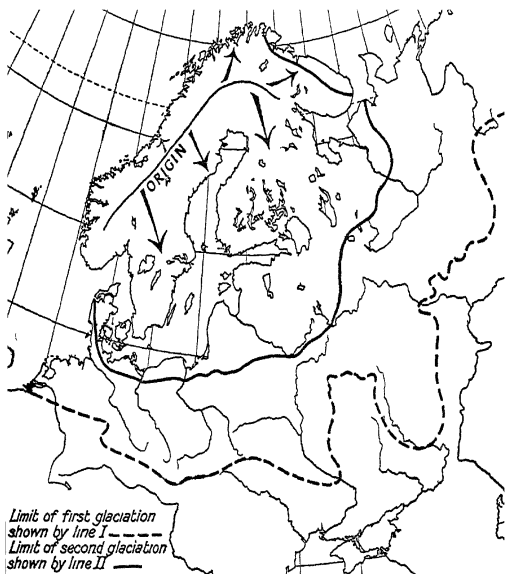


FIG. 42. GLACIATION OF EUROPE. The limits shown are southward.

Berlin, the capital, and Leipzig are the two chief inland cities of the plain. Berlin with its suburbs manufactures many things, of which the chief are textiles, chemicals, machinery, furniture, and clothing. Leipzig, which has a good position for trade on the edge of the uplands, specializes in the manufacture of textiles, and the making of machinery and musical and scientific instruments.

Hamburg, 60 miles up the Elbe, is a great port and imports a great deal of the raw material which comes into the country; it has large shipbuilding yards and many factories. It is easy to understand its importance, by studying the wide communications offered by the

Elbe and its valley. Another North Sea port is Bremen, on the Weser, which, on a lesser scale, has the same industries as Hamburg. Bremerhaven is an outport for Bremen.

Of the seaports facing the Baltic, Stettin and Lübeck are the most important, both being engaged in shipbuilding and Lübeck also in chemical manufacture.

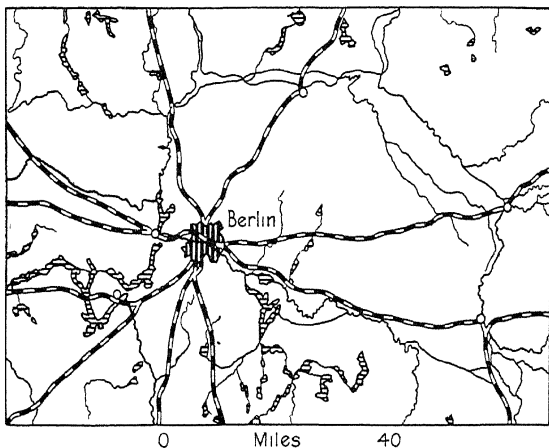


FIG. 43. THE POSITION OF BERLIN.

Königsberg, on the eastern shore of the Gulf of Danzig, is the largest town of East Prussia, a region separated from the rest of Germany by a corridor of land belonging to Poland (p. 134).

In addition to the Rhine and its tributaries there are other important rivers crossing the plain, which have carved out valleys across the uplands. Not only are these valleys important because of their fertility but they provide excellent routes for railways. At the points where these rivers debouch on to the plain, important towns stand. The positions of Cologne on the Rhine, Dresden on the Elbe, and Breslau on the Oder, are good examples.

*The Central Highlands and Valleys.*<sup>1</sup>—The rift valley of the Rhine, possessing a fertile soil largely alluvial, and having a sheltered

<sup>1</sup> On the structure of the central highlands, see Part II, p. 442.

position, produces vines, tobacco, hops, and sugar-beet, which lead to manufactures of wine, beer, and sugar. Frankfurt-on-Main, a river port, is the most important town in the German part of this district ; it is a great banking centre and in addition has important chemical works and breweries.

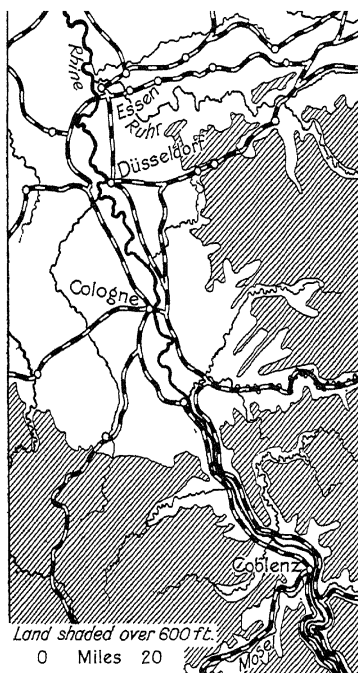


FIG. 44. THE MIDDLE RHINE : its gorge and the outlet therefrom.

The Black Forest and the Odenwald are covered with coniferous forests, and lumbering and charcoal-burning are important. These districts, especially the first, are celebrated for their wooden toys, clocks, and musical instruments.

On many parts of the hills of the Rhine basin there are forests (e.g. Ardennes), but except for fertile valleys large areas are bleak

and bare. A feature of the Eifel district is the large number of volcanic cones, but now there is no sign of any volcanic activity. There are mineral springs at Wiesbaden and Homburg. On the higher parts the population is sparse ; most of the people live in the valleys and here the towns are found. The important valleys are those of the Rhine, Moselle, and Aar, where the cultivation of the vine produces some well-known wines. The vines grow on terraces on the sunny slopes facing south.

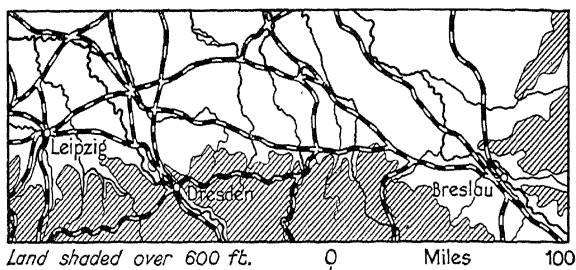


FIG. 45. THE POSITIONS OF LEIPZIG, DRESDEN, AND Breslau in relation to the North German plain and the hill-country to the south.

Besides Cologne, near the outlet of the Rhine gorge, other important towns are Coblenz, within the gorge, where the Moselle joins the Rhine from the south-west, and Mainz, where, near the entrance to the gorge from the rift valley, the river Main joins from the east. The main wealth of this region lies in the minerals which are found on its margins. The positions of the coal-fields (the Ruhr and the Saar) can be seen from the map. They take their names from the tributaries of the Rhine in the valleys of which they lie. The Ruhr coal-field is the most important in Germany, producing more than half of the country's coal. Moreover, the coal is of good quality and gas is obtained from it. Some iron-ore is found here and this started the metal industry, which has grown to be one of the greatest in the world. Iron-ore is imported from Lorraine, Luxembourg, and Sweden, and from the first two this can be done easily by water. There are blast furnaces and iron and steel works in many towns, but the chief centres are Essen, Düsseldorf, and Dortmund, each of which is in the middle of a group of towns.

There is also a big textile industry, the centres for which are Elberfeld and Barmen, and Crefeld is occupied with silk manufacture. Other towns so engaged are Cologne and Solingen, the last of which is also famous for cutlery. Further manufactures on this coal-field are chemicals and glass, while breweries employ many people. Farther to the west, lying near the Belgian frontier, is the small coal-field of Aachen, a town engaged chiefly in iron and textile industries. The coal-field in the Saar valley, the produce of which is ceded to France, is important. Although it does not produce such large quantities of coal as the Ruhr, it is estimated that deeper down than the present level of mining there are great deposits. A number of towns, the most important of which is Saarbrücken-St. Johann, are engaged in iron and porcelain manufactures.

The south-central highlands, including the basins of the Main and Neckar, may be taken as that country which has Nürnberg (Nuremberg) for its centre. In many parts the soil is formed of sandstone and is not fertile, and these areas are mostly forested. In the valleys there is good soil and valuable crops of cereals, hops, and vegetables are grown. Nürnberg is the centre of a great hop-growing region, and so brewing is an important industry here. North of Nürnberg, in Upper Franconia, two important industries have been established—the manufacture of glass and porcelain. For the first, very fine sand, which weathers down from the sandstone, is used and enables a very hard glass to be produced. Decomposition of granite gives china clay, or kaolin (as in Cornwall), which is used for making porcelain. Other important industries are cotton manufactures, printing, and the making of wooden toys.

The Ore Mountains, as the name suggests, have deposits of various minerals, the chief of which are lead and silver. Several towns are famous for fine metal work and the making of jewellery. There are two coal-fields : the larger at Chemnitz and the other by Dresden. Chemnitz and other towns are engaged in cotton and woollen manufactures. The Saxon sheep give merino wool of excellent quality. Much of the work is done in the homes of the peasants. Dresden is famous for its china, and at Meissen there are government porcelain works. Water-power is obtained from the streams coming down from the mountains, and is used in the making of paper, the wood for which comes from the mountain forests.



Leipzig, to the north, is the most important printing and publishing centre in the country. A very old-established industry is that of clock-making.

This region is not well suited to arable farming, except in the valleys ; there is a certain amount of pastoral farming (sheep) on the slopes.

The foreground of the Sudetes, that is the country between Ratibor and Liegnitz, is very fertile. Wheat and rye are grown and other products are hops and tobacco.

On the north-eastern slopes of the Sudetes there is a small coal-field which supports a linen industry. Waldenburg is the centre. Of far greater importance is the Silesian coal-field and industrial district to the south-east in the upper basin of the Oder. It is shared between Germany and Poland, the boundary following an unnatural line through this densely inhabited district. This has been called the ' Black Country ' of central Europe ; zinc and iron are worked and smelted, and steel, chemicals, glass, and textiles are among other manufactures. Beuthen and Gleiwitz are the chief German towns near the boundary, and farther down the Oder is the commercial city of Breslau, already mentioned.

The salt deposits at Stassfurt, near the foot of the Harz Mountains, have helped in the development of chemical works. The rock salt is dissolved by water being pumped down the workings ; then, after pumping up the solution, the salt is obtained by evaporation. It contains not only sodium salts but also potassium and magnesium, which are of great value to German farmers. The Harz Mountains are covered with trees and there is little agriculture, but there are important deposits of minerals (lead, silver, copper). The towns are situated mostly on the north-east slopes.

*The Alpine Foreland.*—The Alps, on the northern side, are formed largely of limestone, so that the soil is mostly dry and unfertile. The Alpine glaciers have strewn moraines across the foreland, which in places have blocked up valleys to form lakes. The climate is not suitable for farming except on the lower slopes. Forests grow on the lowest slopes, but above these dairy-farming is carried on.

It is only along the Danube valley, where the soils are alluvial, that agriculture on a large scale is found. Fine crops of wheat are obtained, and another important crop is hops, which has made

Munich a great brewing centre. Water-power is obtained from the Alpine streams and supplies electricity for railways and works.

From a description of the main features of the three natural divisions of Germany, it will be seen that the extent of forests is considerable ; actually they cover nearly a quarter of the total area. Nearly a half of the land is cultivated, and altogether, nearly a half of the people are engaged either in agriculture or forestry. In the north, beech and oak are fairly common trees, but inland the pine and birch are the chief forest trees. In many parts of the country potatoes are grown, and used not only for food but for making spirits. Sugar-beet is also used for the same purpose and the pulp makes food for pigs. This helps to account for the large number of pigs which are kept. Cattle also are reared extensively.

*Communications.*—There are well over 30,000 miles of railway in Germany and the chief centre of the system is Berlin. The main west-east route from France passes through Westphalia via Hanover to Berlin, and from this point it breaks up into three separate routes, of which one goes north-east via Königsberg to Leningrad, a second continues eastward via Warsaw to Moscow and the third leads south-east by Breslau to Odessa.

Various lines lead from the capital :

1. To Hamburg.
2. The Hanover line serves the Ruhr towns and branches from it go to the North Sea ports—Bremen, Rotterdam, Amsterdam, Flushing, and Ostend.
3. To Leipzig and via Ratisbon to Brenner Pass.
4. To Dresden and Vienna.
5. Via Breslau to Cracow.
6. To ports on the Baltic—Danzig, Stettin, Lübeck.

In the west the rift valley of the Rhine carries the great route to the south. There are railways on both sides of the river. The Moselle is used by the railway leading to Nancy. The Orient Express route is from Nancy via Strasbourg to Carlsruhe. From this point this railway goes south-east via Ulm (on Danube) to Munich and rejoins the river at Linz.

The inland waterways of Germany cover the greater part of the republic. In the west the main highway of trade is the Rhine. The river has been artificially improved and is navigable for small vessels

as far up as Basle ; larger ships can reach Mannheim. It is connected with the French waterways by canals to the Marne and Rhone, and its tributaries, the Main and Neckar, are both navigable, the former by large vessels as far as Frankfurt. From this point the small Ludwig canal leads across to the Danube.

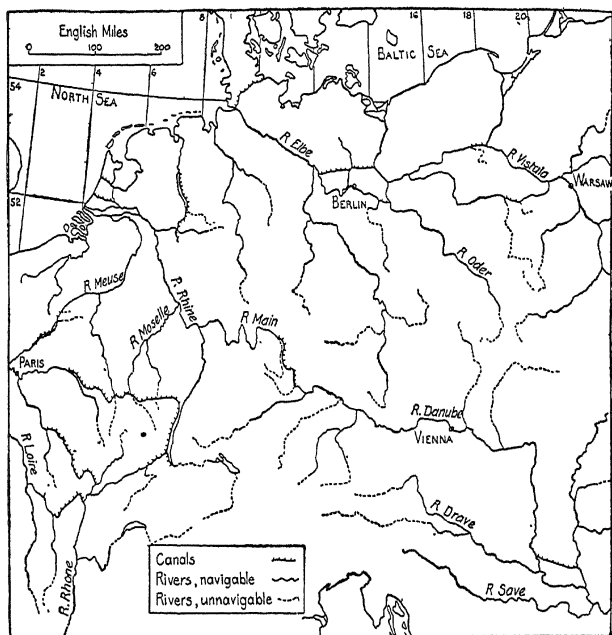


FIG. 46. WATERWAYS OF CENTRAL EUROPE.

The rivers of the northern plain are easily connected by canals, and in many cases the head of navigation of each river has been moved farther up stream by making improvements.

The Ems is connected with the Ruhr district at Dortmund by a canal, and the Weser is connected with this system. The Elbe navigation is a most important system, with Hamburg standing at the head of the estuary. The Moldau, a tributary of the Elbe, is navigable as far as Prag, the capital of Czecho-Slovakia. Dresden

and Magdeburg stand on the Elbe. From Hamburg, a canal leads across to Lübeck, connecting the Elbe with the Baltic Sea. The Kiel canal carries big ships between the North Sea and the Baltic, so that they can avoid the natural passage northward around Denmark.

Breslau and Frankfurt are two important towns on the Oder, which is navigable to the boundary. The Friedrich Wilhelm canal joins the Oder to the Spree, where Berlin stands. The Bromberg canal joins the Vistula and Netze. In this way are the German rivers linked up to give an unbroken waterway from the Bohemian frontier to the North Sea. On the west the system is connected with those of Belgium and France. Certain rivers or portions of them have been made international: the Rhine has been already mentioned in this connexion. Other rivers are the Elbe and Moldau from Prag; the Oder from the Czecho-Slovak frontier, and the Niemen down from Grodno. In each case control of the river is managed by a commission in a way similar to that of the Rhine. The arrangements for the Elbe and Oder give Czecho-Slovakia an outlet to the sea.

*Commerce.*—Germany in modern times has become more and more an industrial country and less dependent on agriculture. A rapid increase in population took place from about 1870, since when it grew from 40 millions to over 60 millions. These extra millions were gradually absorbed into the manufacturing industries which grew up on the coal-fields. This does not mean that agriculture was neglected; rather it was developed, especially by the help of the chemical industry. Germany does not import so much foodstuffs as Great Britain, but has to import wheat and barley. The bulk of the imports are made up of raw materials such as wool and cotton. The exports consist mainly of manufactured goods of which iron and steel goods, cotton and woollen goods hold first places. Other chief exports are sugar and hides and skins.

#### DENMARK

The kingdom of Denmark consists of the peninsula of Jutland with north Slesvik and to the east a number of islands, the largest of which are Zealand, Funen, Laaland, and Falster. The country is

a continuation of the north German plain and is very flat except in the east, where ridges rise like those of the German plain. The west coast is low and sandy, like the North Sea coast of Germany except in the north-west, where the sand-bars, instead of forming islands, become complete and enclose lagoons. Being surrounded by seas, Denmark has a temperate climate, and being a flat country the rainfall is not heavy although the air is moist.

Agriculture is the chief industry and the best land is in the east. About a quarter of the land is unproductive, and of the rest about half is cultivated and half is pasture. The land is divided into small farms or holdings which are mostly owned by the farmers. The products are similar to those of the German plain, the important crops being oats, rye, barley, potatoes, sugar-beet, and other roots. The soil is not very good and in most parts dairy-farming is of greater importance than cultivation. The progress made in this industry has been due in no small part to the use of the co-operative system of pooling the produce. The milk is collected from the farmer and sent to large dairies where it is made into butter. The same method is used for the production of bacon. In Denmark, as in much of northern Germany, the skill of the farmer has overcome the difficulties of an environment naturally poor.

Some beech forests remain, and these give food for pigs, but large quantities of skimmed milk are available too. There are many poultry farms. There is no mineral wealth, so that Denmark has no large manufacturing industries. Ships are built at most of the ports, the largest of which is Copenhagen (the capital) on the island of Zealand. Copenhagen commands the strait through which passes the chief route between the Baltic and North Seas.

Denmark exports most of its produce to Great Britain. Butter, bacon, and eggs forms the bulk of these, but hides, skins, and cattle are also exported and some of these go to Germany. The principal imports are coal and manufactured goods as well as feeding stuffs, such as oil-cake.

*The Faeroes* or Sheep Islands, north-west of the Shetland Islands, belong to Denmark ; sheep-farming and fishing occupy the people.

*Iceland*.—The king of Denmark is also king of Iceland, an island far north in the Atlantic Ocean on the fringe of the Arctic region, between Norway and Greenland. It is larger than Ireland, but has

scarcely a fiftieth as many inhabitants, for six-sevenths of its area are high and bare, and produce nothing. It is in great part volcanic ; Hecla is the biggest volcano still active, and geysers or hot springs<sup>1</sup> are numerous. Around the rocky indented coasts there is a scattered population, especially in the south-west, where there are small expanses of lowland and the climate, under the Atlantic influence, is least severe. The fisheries, chiefly for cod, supply most of the wealth of the island, which is noted also for its ponies. Agriculture is almost confined to growing hay, potatoes, and roots.

*Greenland*, the big Arctic island rising to the north-east of North America, is almost entirely covered by a thick cap of ice and snow, from the edges of which, where they reach the sea, icebergs break off as the pressure of the cap compels a slow outward movement of the ice. The south-western fringe, however, is inhabited by a few hundred Danes and a few thousand Eskimo, and forms a colony of Denmark, trading in products of the Arctic seas, such as those from the seal and whale ' fisheries '. A mineral called cryolite, found in Greenland, is exported for use in the manufacture of aluminium.

### THE SCANDINAVIAN PENINSULA

The Scandinavian Peninsula is a plateau with a steep slope on the western side, and a longer gentle slope to the east and south. The top or dome is called Kjölen, the keel, in the likeness of an upturned boat, and has an average height of 3,000 ft., but in some parts it rises to 8,000 ft. From this dome ice-sheets spread during the Ice Age. On the west side glacial action helped in the formation of deep fiords, and the eastern slope is strewn with glacial deposits.

On the west coast the longer fiords<sup>2</sup> penetrate far into the land, and steep narrow valleys connecting them, and leading inland from their heads, afford difficult land communications. The coast is fringed almost throughout with high rocky islands : the calm waters within them give easy coastwise communication by boat, and the effect of this upon Norwegian life will be seen presently. Islands, fiords, and mountains ; forests, lakes, and swift-flowing rivers, make the Scandinavian peninsula, especially on the Norwegian side, one of the most beautiful regions of its kind in the world. Only in the

<sup>1</sup> Part II, p. 439.

<sup>2</sup> Part II, Fig. 166.

southern part of Sweden (Scania) is there any extensive lowland. The innumerable lakes, as we have already found, are characteristic of glaciated regions. Glacial deposits have been scattered irregularly over the surface and have interfered with the natural drainage by the rivers, with the result that water collects in all hollows and forms lakes.

On the west coast of Norway there can frequently be traced a platform or terrace, just above sea-level, and sufficiently wide for towns to be built on it. Although the formation of the fiords and islands suggests an extensive sinking of the land-surface, the terrace indicates a later raising, of which another sign is found in old sea-beaches raised above the present sea-level.

The mountains divide the peninsula between three climatic regions : the Norwegian coastal fringe belongs to western Europe ; Sweden has the continental type of climate, and the elevation of the keel brings Arctic conditions far southward on the heights. The influence of the warm westerly winds and the ocean currents is seen in the position of the 32° F. isotherm in January, and in the distribution of rainfall. Briefly, the Norwegian coastlands and lower valleys have equable temperatures and high rainfall, while Sweden has more extreme winter temperatures and lower rainfall. This distribution of temperature has an important influence on shipping, especially during winter. The Norwegian ports are free from ice but those of the Baltic Sea are not. The Baltic is generally ice-bound in the north from January till April.

Only in southern Sweden is agriculture possible to any large extent. Elsewhere forests spread wide, though on the plateau the soil is poor, and over wide areas the rocks have been scraped bare by glacial action.

By far the greater proportion of the forests is coniferous, though in the south there is a mingling of deciduous trees. The peninsula is one of the chief timber regions in the world, and yields two-fifths of the European supply. There are rich iron deposits, almost entirely on the Swedish side, but coal is wanting. Charcoal for smelting is obtained from wood, and some coal is obtained from the arctic island-group of Spitsbergen, belonging to Norway.

The kingdom of Sweden has a population of six millions. In addition to the southern arable lands, there are considerable areas

of pasture land which support large numbers of cattle, and butter is exported. Farmers are mostly engaged in the growing of the hardier cereals and food crops for cattle. Roughly half the population is employed in agriculture. Timber and wood-pulp are obtained from the forests. The many rivers are used for floating down the timber and also for generating electricity for saw-mills, paper-mills, and chemical works. Other important products based on forest industries are turpentine, pitch, tar, and matches. A number of towns on the coast are engaged in preparing timber and pulp for export to parts of Europe, especially Great Britain. The most important iron-ore fields are in the far north (Kirunavara, &c.), and in the midland district of Dannemora where Eskilstuna is the chief town. The greater part of the ore goes to Germany but a considerable amount goes to Great Britain. Swedish steel is of excellent quality, and there is a substantial manufacture of cutlery and other metal wares. Considerable quantities of copper, lead, nickel, zinc, and sulphur (for matches) are also mined.

The kingdom of Norway consists, as we have seen, of the more mountainous part of the peninsula. It is about 1,100 miles long and has an area slightly larger than the British Isles, but a population only just over  $2\frac{1}{2}$  millions. As such a small proportion of the land is available for agriculture, there is not sufficient to supply all needs, and grain has to be imported. During the summer months cattle can be fed on the upper slopes of the mountains, and a considerable number are kept. Butter and condensed milk are exported.

Behind the coastal region are the forests, particularly around Trondhjem and in the south-east. In addition to timber and wood-pulp, large quantities of wooden articles are produced. The fast-flowing rivers supply enormous power for saw-mills, and in the south, as in Sweden, for chemical works, and they also help in the transport of the timber.

The third important industry of Norway is fishing, principally for cod, herring, and mackerel. The curing and preserving of fish form an important industry in this connexion. The difficulty of communication by land has compelled the Norwegians to live near the sea and naturally they are a nation of sailors, possessing, in proportion to its size, a very large fleet of merchant ships.

The surface features of Scandinavia make railway construction



difficult except in the south of Sweden. Main lines connect Oslo and Stockholm, the capitals of Norway and Sweden ; Oslo with Bergen on the west coast by a difficult route across the mountains, and with Trondhjem by valleys running northward between Oslo and Trondhjem fiords. Stockholm is connected southward with Gothenburg and Malmö, the principal ports of the south. Northward a line extends well within the Arctic circle, sending off branches to northern Baltic ports, and to Trondhjem in Norway through a marked depression in the Keel. In the far north this line serves the rich iron-fields, and is carried across the frontier to the Norwegian port of Narvik, from which, as the sea is unfrozen in winter, the export of iron-ore can be continued throughout the year.

#### THE EASTERN BALTIC STATES

*Finland* as a whole slopes gently upward from the east coast of the Gulf of Bothnia and the north coast of the Gulf of Finland, and only in the far north are found a few points exceeding 1,500 ft. in height. The south, which contains most of the population, is thickly sown with lakes, and a part of the south-eastern boundary passes through the great Lake Ladoga. In parts the rivers have so far developed as to drain some of the lakes, converting them into peat bogs and marshes. Because of the large amount of standing water and marshy ground in which they breed, mosquitoes are a plague during the summer, but they do not carry disease to man, as in warmer countries. On the hilly ground forests of pine and birch grow, and these are the chief sources of wealth. The soil is poor and only a small proportion (about 2 per cent.) of the country is cultivated, while about one-half as much is available for pasture. The chief occupations are forestry, agriculture, dairy-farming, and fishing. The chief crops are rye, oats, barley, and potatoes, and butter is exported. There are a number of saw-mills using water-power, where wood-pulp and paper are produced. Railways give connexions with Sweden and Russia. The capital is Helsingfors or Helsinki, a port on the Gulf of Finland.

The south-east Baltic coast-lands—that is the country between the Gulf of Finland and East Prussia—form part of the lowland of the north European plain. The northern part resembles Finland, having considerable areas covered with swamps and peat marshes.

Farther south the drainage improves, and the land is drier and more undulating. As in other Baltic lands, the soil is poor but agriculture is generally the chief occupation. The population is greatest near the coast and the largest towns are ports.

The climate is cold in winter and only one or two ports are kept free from ice. The best forests are found towards the south and good use is made of the river Niemen (one of the international rivers) for floating down timber.

The country is divided politically into the three independent states of Estonia, Latvia, and Lithuania, in that order from north to south.

*Estonia*.—On the east the boundary goes through Lake Peipus, and to the north, the town of Narva, which is an important centre because water-power is available, is included in Estonia.

Forests, moors, and lakes take up a large proportion of the surface so that only about 10 per cent. is cultivated. The chief crops are rye, oats, barley, and flax ; and dairy-farming is carried on. Industries include distilling and textile manufactures. Narva is the chief centre, but the largest town and port is the capital Revel, which is not completely ice-bound in winter. Revel imports cotton from the United States, and there is considerable trade with Great Britain.

*Latvia*.—Although there are large marshy areas, there is more arable land than in Estonia. The soil is more fertile and wheat can be grown in the south. Another important crop is flax. In many ways the country is more like Denmark, for we find that dairy- and stock-farming are important. The chief exports are flax, timber, and butter. Among manufactured articles are paper and glass. Riga the capital, standing on the gulf of the same name, and at the mouth of the western Dvina river, is an important port, as well as an industrial centre.

*Lithuania* is unlike the other two states, in having less interest in the sea. It has a comparatively small length of coastline but the territory expands inland. There are large forests, the timber from which is floated down the river Niemen. On this river stands the capital Kovno (Kaunas). Memel is the Baltic port.

The territories of these Baltic republics are as a rule rather sparsely populated : the inhabitants number together between eight and nine millions.

## POLAND

The lowlying land stretching from the Black Sea to the Baltic Sea divides western Europe from eastern Europe : Poland (the plain) lies on the north-western edge of this low land. The Poles are a Slavonic people, being related to the White Russians, the Czechs, and the Slovaks. There are many Jews in Poland.

In the west and south Poland borders Germany, Czecho-Slovakia, and Rumania. To the east stretches the great plain of Russia. The climate is not so severe as that of Russia ; the climatic conditions are transitional between those of western and eastern Europe,<sup>1</sup> but rather eastern (Russian) than western in type. The January isotherm of 32° F. runs north and south through the middle of the country. The rainfall of the plains is light, but it occurs mainly in summer, when it is most needed for crops ; in winter snow falls, but not so heavily as in Russia. Over a large part of the country the soils are formed partly of glacial deposits, and are fertile. In the south-east a portion of the Black Earth country (p. 152) lies inside the boundary of Poland.

Southern Poland consists of a plateau rising in the south to the Carpathian Mountains. The plains are built of young sedimentary rocks, but this hilly country is built of older rocks, which contain minerals. A large part of Poland is drained by the Vistula, which rises in the western Carpathians and enters the Baltic Sea near Danzig. This river gives fair communication by water, except during the winter when it is frozen. In March, when the thaw sets in, the lower basin becomes flooded. Other rivers, having their sources in Polish territory, are the Warthe—a tributary of the Oder—the Niemen, the Pripet, and the Dniester. The Niemen rises in the high ground near the north-east frontier, the other rivers rise in the Carpathians. In many parts of Poland drainage is poor, and there are extensive marshes, especially in the basin of the Pripet, on the Russian boundary.

Parts of the plain are forested (coniferous trees), especially the north-west, but the greater part of this forest has been cleared and the land is given up to agriculture. The chief crops are rye and oats ; some wheat is grown on the best soils, but this crop is more im-

<sup>1</sup> See Part II, p. 510.

portant to the south (Galicia), where the climate is milder. As in Germany, rye is used for making bread. To the west, in the basin of the Warthe (Warta), sandy soil yields large crops of potatoes, and in places hops and tobacco. A good deal of the land in this basin has been reclaimed from marsh. Posen is the chief town of this district.

Southern Poland contains forested plateau, but there are valuable agricultural lands. Large crops of sugar-beet and potatoes are grown. After sugar has been extracted, the beet-pulp is used as cattle food, and cattle-rearing is important in connexion with a leather industry. Potatoes are grown, for food by the poorer people, and in larger quantities for the making of alcohol and starch. In the growing of sugar-beet and potatoes much hand-labour is required, consequently women and children, as well as men, work on the land. Another crop is barley, but more important is wheat, which is grown in the district near Lemberg; in the south-eastern corner of the country maize is grown. Brewing and flour-milling are carried on in the towns.

South-western Poland is important for mining, especially in the Polish portion of the Upper Silesian coal-field (p. 122), where there is a great industrial district. Zinc, lead, and silver are found here, and there are large foundries and engineering workshops. Other less important deposits of these minerals, as well as iron-ore, are found in other parts of south-western Poland. Salt is mined not far from Cracow. Oil-wells are found in eastern Galicia along the Carpathian foreland.

In large towns, like Warsaw, Posen, and Cracow, there are a variety of manufactures; for example, Warsaw (the capital) has distilleries, leather and hardware factories, and sugar refineries; in other towns railway machinery and agricultural implements are made. Lodz, the most important manufacturing town, and the centre of the textile industry, lies in a district where some wool and flax are produced; cotton is imported by way of the Vistula. Many Germans have settled in this town. Agricultural produce and textiles form the bulk of goods exported to other countries; the chief imports are raw wool, cotton, and machinery.

Warsaw, on the Vistula, is the centre of the system of communications; it has a central position in Poland and commands trade between eastern and western Europe. Cracow is an important rail-

way junction. Lodz is badly served by railway, for the line connecting it with the Warsaw-Vienna route is built on a different gauge from the main route.

The Vistula and its main tributaries form a system of inland waterways, which is connected by canals with the Oder (German system) and the Dnieper (Ukraine).

*Danzig*.—This port does not belong to Poland, but is a free city : although it lies in the Polish customs area. Poland is establishing a new port, Gdynia, on the Polish coast. Danzig stands on the Vistula, very near its mouth, and has shipbuilding yards. The chief exports are timber, sugar, and grain, while the principal imports consist of coal, machinery, fertilizers, and foodstuffs. During the winter the port is kept open by ice-breakers.

#### THE DANUBIAN STATES

Below Vienna the basin of the Danube consists of grass land, but above this city the valley narrows and forests grow along it. The grass-lands of Hungary, like those of Rumania, may be compared with those of eastern Europe and Asia, though much less extensive. The people who live on the Hungarian plain (called Magyars) originally came from Asia : they are engaged mostly in agriculture. In the Austrian part of the Danube valley, where the population is mostly German, there are a number of manufacturing centres. On the northern side of the Danube the country is peopled by Slavs, such as the Czechs in Bohemia, the Slovaks and Ruthenians in the Carpathian country. The lower basin of the Danube and the land lying to the north of it form the kingdom of Rumania : Yugoslavia and Bulgaria lie to the south, being a part of the Balkan peninsula. The land occupied by the Austrians and Hungarians forms a wedge separating the northern Slavs from the southern Slavs. In several places the Danube forms the boundary between states. The Danube has long been an international river : the free zone extends up to Ulm, and there are free zones along tributaries ; thus states which have not direct access to the river have waterways connected with it. It is to be remembered as the one great west-and-east river-route in Europe.

## Europe : West, North, and East

### CZECHO-SLOVAKIA

This republic includes the provinces of Bohemia and Moravia, northern Hungary, and a small part of Silesia. Czechs and Slovaks form the greater part of the population, but a large number of Germans and some Magyars live in the country. As in Poland, most of the Germans live in manufacturing towns. The Czechs are found on the plateau of Bohemia, the Slovaks in the eastern half of the country.

The climate of Czecho-Slovakia is rather continental in type : it lies in the same latitude as northern France, but the range of temperature is greater. Prag has a mean monthly temperature varying from 30° F. in January to 67° F. in July. Bohemia, being hemmed in by mountains, has a mean annual rainfall of only 20 inches, but the higher parts of Slovakia get heavier rainfall, and deep snow in winter. In most districts the rain is sufficient for agriculture, and in the valleys and lowlands the range of temperature is not so great, while the summer heat will ripen maize. The vine is cultivated on sheltered slopes and in valleys. On the slopes of the mountains forests grow—oak and beech on the lower slopes, pine and fir on the upper. We may divide the country into three natural divisions (*a*) the Bohemian plateau, (*b*) Moravia, and (*c*) Slovakia.

The Bohemian plateau is separated from Slovakia by the Moravian lowlands, formed by the valleys of the upper Elbe, the March, and the Thaya ; the narrow, lowland passage, between the Carpathians and the Sudetes, is called the Moravian Gate. These valleys provide a route for the Berlin-Budapest railway, connecting the northern plain of Europe with the plains of the Danube basin.

(*a*) The Bohemian plateau is bounded on three sides by mountains—the Bohemian Forest, Erz Gebirge (Ore Mountains), Giant Mountains, and Sudetes. They are highest in the south-west, where the mountains of the Bohemian Forest rise to 4,000 ft. On the south-east the plateau slopes down to the plain of Moravia. In the north the Elbe has cut a deep valley through the mountains ; this river and its two chief tributaries, the Moldau and Eger, drain the greater part of Bohemia. Rye, oats, barley, and wheat are grown in that order of importance. The most productive soil is found in the north, where the upper Elbe and its tributaries have formed alluvial

deposits : such districts as the ' Golden Road ' (near Königgratz) and the ' Garden of Bohemia ' (near Leitmeritz) produce excellent crops of hops and sugar-beet. To the north-west, volcanic rocks have weathered down to give good soil, and one fertile district near Teplitz is called ' Paradise '. The collecting centre for the produce of these districts is Aussig, on the Elbe, from which place goods are sent by river to Hamburg. Potatoes are a staple food of the inhabitants, and large quantities are used for the distillation of alcohol. Hops and barley are used for making beer : there are breweries in many towns but the chief centre is Pilsen. Most of the sugar refineries are found in Prag and the district around this city. Apples, pears, and other orchard fruits are produced in quantities. Carlsbad is noted for its plums.

Large numbers of sheep and cattle are reared. Bohemia is rich in minerals, including coal, lignite, and iron, and many manufactures depend on them. Fine sand, found along the slopes of the Bohemian Forest and in other parts of the country, is used in glass-making : Bohemian glass has long been famous. Near Carlsbad there are large deposits of kaolin (china clay), from which porcelain is made. Among other minerals is graphite, from which pencils are made. The forests provide good timber and also pulp for the paper-mills of Prag and Pilsen ; furniture-making is carried on in various parts.

Prag (the capital), standing at the head of navigation on the Moldau, has other industries besides those already mentioned, the most important being the manufacture of textiles, leather, gloves, and chemicals. Carlsbad and Marienbad are famous for their mineral springs.

(b) In Moravia the hill-slopes produce crops of rye and potatoes ; the valleys, sugar-beet, cereals, and vines, those of the March and Thaya being exceptionally productive. In the district around Olmütz hops are grown. As in Bohemia, sheep and cattle farms are numerous : the sheep are found on the hill-slopes, while the cattle feed in meadows along the river banks.

Good supplies of coal and iron have made this an important industrial district. Coal-fields stretch from Mährisch Ostrau, lying

Sweden by the Oder. Lignite is obtained in the district of Brünn (Brno), where a textile industry is centred. At Brünn and Iglau woollen goods are chiefly produced, and linen and cotton goods at Troppau, and other towns lying in the north of Moravia. Raw material is imported as local supplies of wool and flax are insufficient. Brünn has other industries, such as the manufacture of chemicals and machinery.

(c) The Slovaks are less advanced than the Czechs, and the resources of Slovakia have not been developed like those of Bohemia. The highest part of Slovakia is the Tatra (8,737 ft.), on the Polish boundary. In the north-east the boundary runs along the crests of the Carpathians as far as lat.  $48^{\circ}$  N. The mountainous part of Slovakia is forested. The Carpathians consist partly of sandstone ridges (the Tatra has archæan rocks), which have soils particularly favourable to the growth of trees; oaks and beeches grow on the lower slopes, pines on the upper. Parts of the higher ground are bleak and this is especially the case toward the eastern end of Slovakia, where the population is Ruthenian. Where land is cultivated, potatoes are grown. From the highland regions, the land slopes down to lowlands on the southern side. Down these slopes rivers have carved out valleys—some longitudinal as in the Alps. The lowland is fertile, the climate is warm, and good crops of sugar-beet, wheat, and maize are grown. In sheltered valleys tobacco and vines are cultivated. The lowland drained by the Waag and Gran is called the 'little Alföld' (plain): Bratislava (Pressburg), an old fortress town standing on the Danube, is the market-centre for this district. Toward the east of Slovakia there is a small plain drained by the tributaries of the Theiss (Tisa).

In the mountains there are deposits of minerals, the most important being iron-ore, lignite, and copper. Oil-fields are of some importance. Good wine is produced along the slopes at the foot of the Carpathians: Tokay, just across the border in Hungary, is famous for its wine.

Czecho-Slovakia is far from the sea, but the Elbe and Oder (free rivers) give access to the ports of Hamburg and Stettin, where there are free zones; from Bratislava goods are sent along the Danube to the Black Sea. A canal connects the Oder with the March, thus giving a continuous waterway between the Baltic and Black Seas.



There is rail communication with the Italian port of Trieste, on the Adriatic Sea. Bohemia and Moravia are well served by railways, but Slovakia is not.

Czecho-Slovakia trades mostly with neighbouring countries, especially Germany, Poland, Austria, and Hungary. The chief imports are raw materials, cotton, wool, and metals being most important. Sugar, textiles, glass, gloves, beer, and furniture are the principal exports.

### AUSTRIA

The Danube has a course of more than 200 miles in Austria between the tributaries Inn and March. It enters the country from Germany by a gorge, and in other places the valley is narrow. Nearly half the country belongs to the Alpine system. The eastern Alps are lower than those of the west—Gross Glockner, the highest point in Austria, reaches 12,461 ft.—but the limestone ranges on the northern and southern margins are more fully developed here. They are separated from the higher central chain by longitudinal valleys, those of the Inn and Ems in the north, the Drave and Adige in the south : the valleys are most important for lines of communication. The climate of the lowland differs from that of the Alpine region. Vienna has cold winters and hot summers, the average monthly range of temperature being from 29° F. to 70° F., but the extreme range is from 2° F. to 94° F. ; the rainfall is small, the driest parts around Vienna getting less than 20 inches in a year. The Alpine region has warm summers with good rainfall and severe winters with heavy falls of snow. In the valleys the mean temperature varies according to the direction in which they face : those facing the east have cold continental winds in winter ; under the influence of the warm *föhn* wind some of the northern valleys are warmer ; the southern valleys are warmest.

On the lower slopes of the Alps there are forests of beech, oak, and chestnut ; pine and fir forests grow at higher altitudes. Good pasture is found in the valleys and above the line of forest.

We may thus divide the territory of the republic of Austria into two natural divisions—the plain of the Danube and the Alpine division.

The Danube valley and the eastern margins of the Alps include the most important farming lands. These lands produce maize and

wheat, but rye is more important. Large quantities of potatoes and hay—winter food for cattle—are grown. Other crops are sugar-beet, flax, and hops, with vineyards in the Vienna district. On most farms cattle and pigs are kept ; in summer the cattle are driven to the mountain pastures and the pigs feed on acorns and beech-nuts in the forests. Sheep-farming is of some importance in the hilly district along the north side of the Danube.

In Upper Austria one-third of the area is forested : wood-pulp is obtained for paper-making. Along the Alpine foreland is found lignite, which is used in an iron and steel industry. There is also some manufacture of woollens.

Between Linz and Passau there are deposits of china clay. The Salzkammergut, in the south-west of Upper Austria, has salt deposits. In the same district are many mineral springs. The Alpine lake district of Austria is very beautiful and attracts many visitors from central Europe. Lignite is found in Lower Austria too ; there are iron-foundries, but more important is the manufacture of textiles. Power is obtained from the rivers which flow down the Wienen Wald, and towns such as Neustadt and Baden are centres. Among other industries of this district are milling and brewing. Vienna lies near the eastern end of the Alps. Its population is not much less than one-third that of all Austria, and it is the chief industrial centre of Austria, producing leather goods, textiles, furniture, machinery, and metal goods.

Alpine Austria stretches as far as the Lake of Constance in the west, and the southern boundary follows the crests of mountain groups, such as the Karawanken, Carnic Alps and Höhe Tauern. In the east, the Semmering Pass provides a route across the Alps, but to the west of it rises the high chain of the Höhe Tauern, and there is no pass sufficiently low for a railway route until the Brenner (4,470 ft.) is reached. A tunnel through the eastern end of the Höhe Tauern carries the railway from Salzburg across the Alps.

The Alpine provinces are mostly engaged in forestry, cattle-farming, and the cultivation of rye and oats, but in certain districts, especially at the eastern end, there are manufacturing industries. In dairy-farming, methods like those used in Switzerland are employed (p. 143). The cultivated lands are found in the valleys : the northern valleys produce rye and oats ; the southern valleys, the vine.

The main industry of Austrian Tirol is dairy-farming, while mining for iron, salt, and zinc is of some importance. Innsbruck, on the Inn, the capital of this province, has cotton and woollen mills. The beauties of Tirol attract many tourists. The railway across the Brenner pass runs almost due south from Innsbruck, connecting the German system and the great west-east route north of the Alps with the railways of Italy.

The northern province of Salzburg consists chiefly of limestone country, where communication is difficult on account of the gorge form of the valleys. The district is sparsely populated. The city of Salzburg, on a beautiful site, is famous for its marble buildings ; the stone is quarried at Adnet. The chief deposits of minerals are found in the provinces of Styria and Carinthia. In northern Styria, Eisenerz is the chief iron-ore centre of Austria. From the Erzberg, or ' ore mountain ', iron-ore has been quarried for over 2,000 years. Graz, in Styria, Klagenfurt, and Villach in Carinthia are industrial centres. Carinthia includes the upper valley of the Drave, which divides the main Alpine chain from the limestone belt to the south, and provides a route east and west along the Alps. The railway from Vienna, across the Semmering pass, divides into two at Brück : both branches follow the Mur valley for some distance, the easterly branch through Graz forming the route to Trieste, the other the route to Venice. Nearly half the country is forested ; wood and paper are produced.

The principal imports of Austria are foodstuffs, coal, and textiles : the coal is obtained from the Silesian mines. Lignite, cattle, and timber are exported, in addition to certain specialized manufactures. Vienna and neighbouring towns manufacture iron and wood furniture, matches, velour hats, and chemicals for export ; wooden toys and other articles are made by peasants in Tirol and Salzkammergut.

#### SWITZERLAND

Having returned, in Austria, to the Alpine region, it is appropriate to consider the Alpine republic of Switzerland, before continuing our view of the Danubian states. Switzerland lies in the heart of Europe, with France, Germany, Austria, and Italy as neighbours. It is a land of mountains, containing the highest parts of the Alps—the Bernese Oberland, and parts of the Pennine, Adula and Rhaetian

groups—and a plateau district north of these mountains. Mont Blanc stands outside its boundaries, but many high peaks—Monte Rosa, the Matterhorn, Jungfrau, &c.—are within them. On the north-western edge of the plateau stand the Jura Mountains, separating Switzerland from France; in the north, the boundary with Germany is formed by the Rhine and Lake Constance. The high

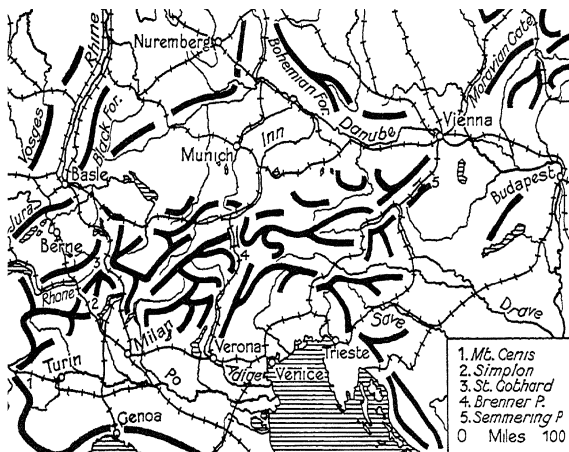


FIG. 47. Guide to the main ranges and passes of the Alps and neighbouring mountain-systems. The thick lines show the general directions of main ranges.

central chain of the western Alps, formed of crystalline, archæan rocks, is flanked on the north by lower limestone and sandstone mountains. The southern slopes of the Alps are steep, and there is an abrupt descent to Italy by a series of steps. On the northern side the mountains slope more gently to a sandstone plateau.

The chief rivers of Switzerland radiate from the St. Gothard: the Ticino to the south; the Rhine to the north-east; the Aar and Reuss to the north; the Rhone to the south-west. The Rhine and the Rhone flow in deep longitudinal valleys before turning in a northerly direction, while the Aar and Reuss flow in broader valleys across the plateau to join the Rhine. All five rivers enter lakes on the margins of the Alps<sup>1</sup>—Geneva, Lucerne, Como, &c. These lakes

<sup>1</sup> See Part II, p. 446.

regulate the flow of the rivers lower down, and prevent floods. In the western Alps, apart from the upper Rhine and upper Rhone, the rivers flow in a general direction at right angles to the trend of the mountains—they are transverse—whereas the rivers of the eastern Alps flow in longitudinal valleys. Thus in the western Alps we find more passes than in the eastern. The rivers are important for several reasons: they lead up to passes, giving openings for communications; railways are built along their valleys; they are harnessed to give water-power; very fertile land is found along the valley bottoms.

The climate is that of central Europe, but conditions vary considerably in different parts. The northern part, the lowest, is warmest, having conditions similar to the adjoining parts of France and Germany. Over the plateau the mean January temperature ranges from about 32° F. in the lowlands to 26° F. in the higher parts, and the July mean from about 68° F. in the former to 62° F. in the latter. The greater part of the country has a northward exposure; only certain deep valleys and slopes opening south have high summer temperatures. Parts of the Engadine (6,000 ft.), with a southerly aspect, have a mean summer temperature over 75° F., whereas during the winter—which lasts six months—the temperature may fall to 10° F. below zero. This is a climate of extremes. In any valley, the slope which faces the sun has a higher mean temperature than one which looks away from it, in fact the difference may be equivalent to a difference of many degrees of latitude. Precipitation varies according to exposure and the direction of prevailing winds. Quite generally the mean annual rainfall ranges from 30 inches to 40 inches, but some high parts get as much as 90 inches, and districts leeward of mountains as little as 22 inches. Those valleys into which prevailing winds can blow directly have good rainfall, thus the open valleys of the Aar and Ticino—exposed to the sun—are more fertile than the deep gorges of the Rhine and the Rhone. The *föhn*, a warm dry wind from the south, blows down certain northward valleys in spring. In these valleys the winter snows are melted quickly, and spring comes early. The higher parts of the Alps are always covered with snow, which accumulates in hollows to form snow-fields, the sources of glaciers. The position of the snow-line naturally varies in different parts and according to the seasons. It is lower on the northern than on the southern slopes,

and on both slopes it is lowest in the west, where precipitation is greater than in the east. Generally, the snow-line is somewhere between 8,000 ft. and 9,000 ft. All surfaces above these limits are not covered by snow : many of the slopes are too steep for snow to rest on them. It is estimated that one-twentieth of the area of Switzerland is covered by permanent ice and snow. During the geological period known as the Ice Age, the Alpine glaciers were more extensive than now, and the lower, as well as the higher, valleys were filled by ice. When the valleys became free of ice, the moraines served as dams to prevent the water flowing away, thus forming lakes in the valleys (Part II, p. 448).

Switzerland is a republic. Owing to the long period during which the inhabitants of the different valleys lived isolated lives, its divisions, to a large extent, developed independently, and only those affairs which affect the country as a whole are managed by the central authority of the republic. Switzerland has had a chequered history, and this is shown by the divisions among the people in language and religion : the majority of the people speak German (71 per cent.), but a large number speak French (21 per cent.), and some Italian, &c. Similarly, they are divided into Protestants and Catholics.

The country falls into three divisions : the Alps, the plateau region, and the Jura. About a quarter of the land is cultivated ; a quarter is pasture—grass and meadows—a little more than a fifth is forested, and the remainder is unproductive. There is very little mineral wealth. In the Alpine region the cultivated areas are found only in the valleys. Most of the land not covered by snow is either forested or pasture. On the middle slopes the forests are of pine, fir, and larch ; the beech grows on the Alpine foreland, the oak and chestnut along the southern valleys. In the valleys cereals, vegetables and fruits are grown, but the pastoral industry is most important. Sheep and goats are kept, but all the best pastures support cattle. Above the forest belt, and stretching up to the snow-line, there is rich pasture, available only in summer. This summer feeding-ground, which is above the clouds in winter, is called by the inhabitants the *alp*. The fine soil, bright sunshine, and abundant moisture help the quick growth of plants and flowers, forming an excellent food for cows. During the winter the cattle live in the

valleys ; in spring they are driven to the pastures of the lower alp (just above the forest) ; when the snows have melted, to the alp proper. The cows give rich milk, of which there is a big surplus. Some of it is made into cheese—that of Gruyère is well known ; some is condensed ; and some is used in the manufacture of milk chocolate. These are important articles of export : Neuchâtel, Vevey, Berne, Lucerne and other towns are engaged in their manufacture. Leather is made from hides and goat-skins, and boots and shoes are

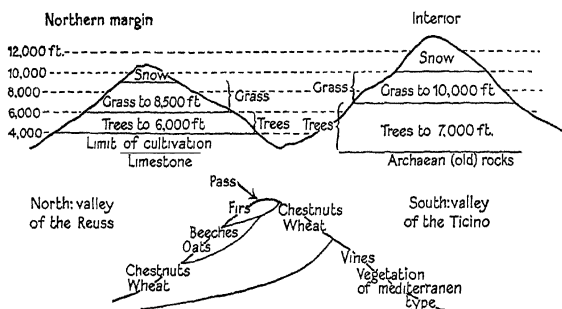


FIG. 48. Diagrams illustrating (above) the distribution of natural vegetation, (below) differences in cultivation on northern and southern slopes, of the Alps.

manufactured. The wines of the Ticino valley, of the country around Montreux, and of Valais, are of good quality. The Ticino and other southern valleys are almost Mediterranean in type : they produce maize, mulberries, and in places olives.

The mountain scenery in Switzerland is among the finest in the world, and every year—both in winter and summer—thousands of people visit this country. In addition to the beauties of the Alpine scenery, there are other attractions in the form of mountain-climbing and winter sports ; and Switzerland is well named the ' playground of Europe '. A large number of hotels have been built, and many people are employed in connexion with the tourist traffic ; thus the population of the Alpine region is considerable.

On the central plateau the climate is warmer and more land is available for agriculture. Cereals are grown, but the amount produced is far from sufficient to meet the home demand. Less than 15 per cent. of the land is under grain ; large crops of potatoes are

grown for food ; and many districts grow sugar-beet. Sugar is needed for the manufacture of chocolate. The vine is grown in some districts, but in the north, hardier fruits, especially cherries, are more common. The Jura region, consisting chiefly of limestone, has a poor soil, and pastoral farming is more important than agriculture. More important are the manufacturing industries, in which nearly a half of the employed persons of Switzerland are engaged. Switzerland possesses little raw material and no coal for manufactures, yet Swiss goods are found in almost every country in the world. Switzerland has certain advantages of its own : there are great reserves of water-power, which compensate for the lack of coal, and good supplies of cheap skilled labour. Electricity, derived from water-power, is used for driving machinery, lighting, and to a large extent for railways. Falls and rapids, chiefly on the Rhine, Aar, and Limmat are utilized, the chief power centres being at Geneva, Berne, Schaffhausen, Brugg, and Baden. Some coal is imported for domestic use and for railways.

Among the manufactures are textiles, machinery, watches and clocks. As most of the raw material has to be imported, many small articles, requiring a large amount of skilled labour, are produced. Both cotton and silk goods are manufactured : the cotton-spinning centres are in the north-east, in and around Zürich ; embroideries and lace are made in the cantons of St. Gall and Appenzell ; and Berne is another centre. The chief silk centres are Zürich and Basle, the latter for ribbons. Switzerland exports large quantities of the cheaper materials, made partly of silk and partly of cotton. The raw cotton comes from North America through North Sea ports, the raw silk from Italy by the St. Gothard railway.

Zürich is also the centre for the manufacture of machinery, other towns engaged being Baden, Basle, Berne, and Winterthur. Textile machinery, electrical machinery, locomotives, and motor-cars are made. Boots and shoes are manufactured and exported.

Watches and clocks are made in towns situated in the Jura. This industry, like the cotton, was started in the homes of the people, who have inherited a fine skill in metal work, but in recent years factories have been built and the output increased. Musical boxes, scientific instruments, and jewellery are also made. Most of the products of these metal industries are of small bulk, and easily



exported overland. Chemicals, especially dyes and drugs, are made at Basle, and Schaffhausen manufactures aluminium goods.

The capital of Switzerland is Berne, on the Aar, but Zürich and Basle are the largest towns, being manufacturing centres. Switzerland has an excellent commercial position, lying at the intersection of important routes : the route from the Rhine to Italy and the Mediterranean ports crosses the eastern route from the Rhone valley. Owing to its central position among the important European

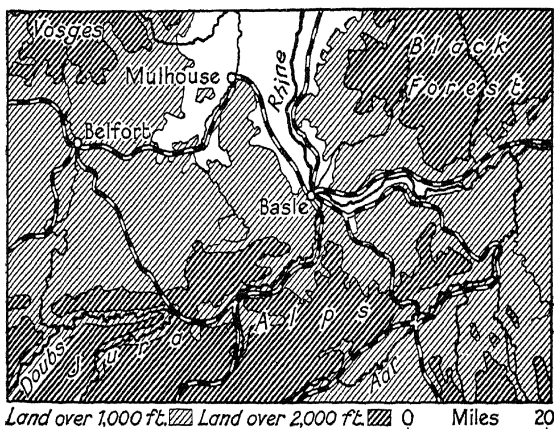


FIG. 49. THE POSITION OF BASLE.

countries, Switzerland contains the head-quarters of the League of Nations (at Geneva) and of several international bureaux—the International Labour Bureau, the International Railway Administration, the International Postal Union, and the United Telegraph Administration.

The main trade routes are from Basle, by the Rhine valley to Antwerp and Rotterdam ; from Geneva, by the Rhone, to Marseilles ; through the St. Gothard tunnel or by the Simplon pass to the Italian ports (chiefly Genoa). Small manufactured goods (watches, &c.) are exported through Havre and other French ports ; raw cotton is imported through Havre and Bremen ; grain, coal, and iron chiefly through Rotterdam. Hamburg and Bordeaux get a share of Swiss trade.

Of the large number of countries with which Switzerland trades, France, Germany, Great Britain, the United States, and Italy rank first ; goods are sent also to other European countries, to Japan and to Australia. Those countries, named in the first group, also supply the greater proportion of the imports to Switzerland.

Switzerland possesses good railways and excellent roads ; in the Alps are some of the finest mountain roads in the world. The main railway routes have been mentioned already (p. 97) as parts of the transcontinental routes. There are many light railways worked on a tooth-wheel system to travel up and down steep slopes. A large part of the railway system is electrified, using water-power, and it is planned to run the whole system by electricity.

#### HUNGARY

Hungary consists almost entirely of lowland, which forms the greater part of the middle plain of the Danube. The Bakony Forest and the highlands north of Budapest are the only hilly parts, but the plain is hemmed in on all sides by mountains. The Danube enters the country by a gap near Bratislava and leaves it by a gorge. This river and its large tributary the Theiss (Tisa), both flowing in a southerly direction across the plain, are important for transport. The plain is mostly fertile, although in places, especially between the Danube and Theiss, there are long rows of sand-dunes. Both rivers are liable to flood, especially the Theiss, the banks of which are strengthened artificially : this helps to account for the absence of towns (excepting Budapest) along the banks of these rivers. The region between the rivers is subject to bad sandstorms, and the planting of trees and plants with spreading roots is necessary to prevent shifting of sand. The river Drave forms the south-western boundary, and fairly closely divides Magyars from southern Slavs. The Hungarians are Magyars, but there is a sprinkling of Germans in the towns, and a number of Jews have big interests in industries and own land.

The climate is more continental than that of Austria. To some extent the Carpathians protect the lowland from cold northerly winds, but the average winter temperature is below freezing-point. In summer it is usually hot, and owing to lack of moisture crops are sometimes scorched, but the rainfall may be sufficiently heavy to

cause floods. Few trees grow, as the climate favours a steppe vegetation. These grass-lands are called *pusztas*, a term meaning 'desert': originally, it was probably applied to sandy and marshy wastes, when they were more extensive. Large areas of marsh have been reclaimed and sandy areas forested.

The industries of Hungary are almost entirely agricultural. In towns there are industries connected with agriculture—flour-milling, brewing, distilling, and sugar-making. Owing to the dry climate, wheat, the most important crop, is of a particularly hard kind, very suitable for milling. Maize ranks second to wheat, but Hungary produces more than any other country in Europe. This crop, requiring warmer conditions than wheat, is grown in the south and east.

In early times, cattle-rearing on the steppe was the chief occupation of the Hungarians, but now there is less pasture available, the land being under plough. The cattle are fed on various fodder-plants, such as lucerne, and fattened on maize and beet-pulp. The rearing of horses, pigs, and sheep is also important. In the west, where light soils predominate, rye is the crop, while the higher ground produces barley and oats. Large crops of sugar-beet are grown for the manufacture of sugar, while other plants include tobacco, flax, hemp, and hops. Tokay in the north, and Sopron, beside Neusiedler Lake, are centres of vine-growing districts.

There are few towns in Hungary; the agricultural centres rather resemble enormous villages, containing many farms, and covering an area of a hundred square miles or more.

Budapest, the capital, stands just south of the point where the Danube bends southwards: Buda on the west bank, and Pest on the east are connected by bridges. This is the commercial and industrial centre of Hungary and from it railways radiate to all parts of the country. Pest is the modern part of the capital, and here the greater expansion has taken place. Budapest manufactures iron and steel goods, agricultural machinery, leather, textiles, and there are breweries and distilleries.

The chief exports are flour, wheat, rye, cattle, meat, and eggs; the imports, agricultural implements, metals, textiles, timber, and household articles. Most of the trade is carried on with Austria, Czechoslovakia, and Rumania. The Danube and Theiss have winding

courses, but canalization has greatly reduced distances. Steamers can ascend to Tokay on the Theiss, rafts being used above this town ; the Drave is navigable for steamers to the confluence of the Mur, and by smaller boats to Villach in Austria.

#### RUMANIA

The kingdom of Rumania (better, Romania) extends in the west to the eastern fringe of the Hungarian plain ; the river Danube forms most of its southern boundary ; the Black Sea and the river Dniester limit it on the east. The northern boundary crosses the eastern Carpathian Mountains, which are continued southward, through the centre and west of Rumania, by the Transylvanian Alps. The people speak a language of Latin origin, and call their country Romania. They claim descent from a colony of the Roman empire ; but Slavs have mixed with the Rumans, and there are many Magyars (especially in Transylvania), Bulgars, Turks, and Germans. Owing to these influences the language has undergone change.

The mountains divide the country into two parts : in the east they slope down to the plateau of Moldavia ; in the west to the plain of Hungary. The plateau bordering the east of the mountains is a continuation of that of Galicia ; the plain north of the Danube and west of the Black Sea a continuation of the Russian plain. The Danube has rapids at the Iron Gate, in the south-west of the Transylvanian Alps, where it flows through a series of narrow gorges, sixty miles in length : navigation follows an artificial channel. From the Iron Gate the river flows south-easterly, following the inner curve of the Balkan Range ; it bends sharply north on reaching the Dobruja plateau ; and again turns east just before entering the Black Sea. Owing to the absence of tides the river has a delta, with three large distributaries, one of which is kept dredged for shipping. The climate, like that of Hungary, is continental. The temperature may change suddenly, and during the year it ranges from below zero to over 100°F. On the highlands rainfall is considerable, but on the plains the crops fail in some years on account of drought. During January and February the Danube is closed by ice.

The mountains are forested up to a height of 5,000 feet, with oak and beech on the lower slopes, pine above. On the south-eastern margins of the highlands there are valuable deposits of petroleum

and salt. The foothills and the Walachian plain, north of the Danube, form the most important lands of the kingdom.

The population on the plain is partly formed of hill-people, who during the centuries have spread plainward : they are either agriculturalists or stock farmers. Among the latter are wandering shepherds, who move their flocks up and down the hills according to season.

The forests have good timber, which is floated down tributaries to the Danube ; acorns and beech-mast provide food for pigs. There is good pasture on the hills, and hay is grown on the plains, so that cattle-farming is important. Toward the north of the country, on the north-east slopes of the mountains, lies Bukovina (' beechland '), where many cattle and sheep are reared. There are cultivated valleys and basins lying in the mountains ; those slopes facing the south have vines and fruit trees growing on them, others oats and potatoes. More important are the western slopes and plains : maize in Transylvania, wheat and maize in the Banat and Maros valley are the chief crops.

The district of Bessarabia is similar to the Russian lands adjoining it to the east. The principal crop is maize ; others are wheat, barley, and flax. In Moldavia considerable areas are devoted to pastoral farming, but there are good crops of maize and wheat. Forestry is of some importance and glass is made. While maize is the chief crop of the plateau region, wheat is the great crop of the plains. In Walachia the soil is exceptionally fertile, being like that of south Russia (p. 151), and half the plain is under wheat. This is the most densely populated part of Rumania and the large towns are situated here : as in Hungary, the agricultural centres consist of huge villages. Other crops are sugar-beet and tobacco, while the vine is cultivated, and fruits, including plums (dried for prunes) are grown in hilly districts. Excepting Galatz and Braila, none of the large towns stands on the Danube, the north bank of which is low and often marshy. Bucharest, the capital, stands on a tributary of the Danube. Galatz and Braila are grain-exporting ports. Sulina, although a small port, is of great importance. The Sulina Channel has been artificially straightened, and huge jetties built, to give shelter against storms coming up from the Black Sea.

A little coal is mined along the foothills, but far more important

is petroleum. The chief output is from the district (near Ploesti), to the north-west of Bucharest, and the district to the south-west of Jassy. Pipe-lines run from the oil-fields to Constantza on the Black Sea (a port free of ice during winter) and to Giurgiu on the Danube. Salt is mined in Moldavia.

In addition to the export of wheat, maize, and petroleum, there is some trade in barley, oats, timber, cattle, salt, and hides. Germany and Austria supply Rumania with various manufactured goods, such as textiles, iron and steel goods, and articles for domestic use. Large quantities of agricultural machinery are supplied by Great Britain and the United States.

Bucharest is the chief centre of a railway system of which the main lines enter the country from Hungary through the Iron Gate and from Poland along the eastern edge of the mountains; lines connect with the Danube ports and are carried by a bridge across the river and so to Constantza.

## RUSSIA

The European plain has its greatest extent in Russia, where it stretches from the Carpathians to the Urals, from the Baltic Sea and Arctic Ocean in the north to the Black and Caspian Seas in the south. The Urals, the Timan mountains in the north-east, the Crimean and Caucasus mountains in the south, are the only folded ranges. The sedimentary rocks of the plain, lying horizontally, are soft, like clay; hard rocks, useful for building purposes and for the construction of roads &c., are lacking. The irregularities of the land surface, the large number of lakes, and the poor drainage of the northern part of Russia are the result of glaciation during the Ice Age (Part II, p. 448). South of line I on fig. 42 lie the Black Earth lands, the most fertile part of Russia. This black soil has probably been formed by the mixing of silt, derived from the melting ice-sheet, with vegetable mould. A line running from the bend in the Carpathians to the southern end of the Urals, marks roughly the southern edge of the Black Earth lands. From them the country slopes gently down to the Volga and Black Sea, forming steppe; to the south-east is the Caspian depression, semi-desert country, lying below sea-level.

West of long.  $45^{\circ}\text{E.}$ , and north of line I on Fig. 42, the boulder-

clay left by the ice lies in ridges, spreading from the north-west (the origin of the ice) toward the south and south-east. Water collecting in the hollows between the ridges formed lakes, and the rivers naturally flow along the hollows. Over this vast plain of Russia there is an extraordinary uniformity of relief. Its flat surface is monotonous. Certain parts rise slightly. Looking at a contoured map of Russia, we see a belt of hilly country stretching

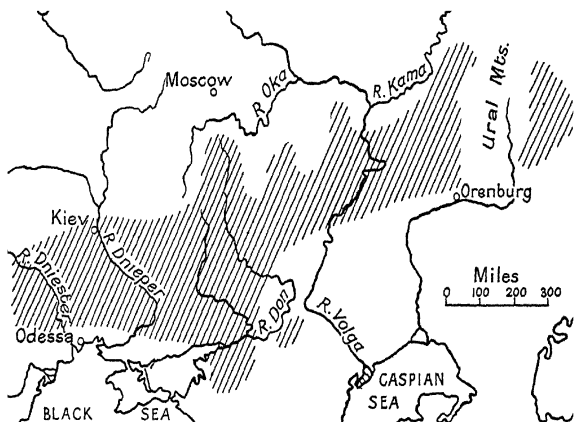


FIG. 50. THE BLACK EARTH BELT (shaded) IN RUSSIA.

from the Valdai Hills to the Sea of Azov : this belt lies between  $30^{\circ}$ E. and  $40^{\circ}$ E.—except in the south where it broadens between the Carpathian foreland and the Don basin. More high ground rises to the south-east of Vilna ; in the upper basin of the Volga ; and in the district of Ufa. On the map, the hills appear to stand out rather boldly, but actually they do not, for the changes of level are gradual and scarcely noticeable to a traveller crossing Russia.

In their lower courses the rivers flow along open and often marshy plains—they have worn the hills down by widening their flood-plains (see Part II, p. 445)—but in their upper courses they flow at the bottoms of deeply-cut valleys. Excepting those which flow into the Arctic Ocean, the rivers rise in the hilly country—the central plateau—south of the Valdai Hills.

The western Dvina and Niemen flow to the Baltic Sea ; the Volga, joined by its tributary the Oka, to the Caspian Sea ; the Don to the Sea of Azov ; the Dnieper and Dniester to the Black Sea. All these rivers, with the exception of the Dniester, rise in the central plateau. The Pechora, northern Dvina, Onega, and Mezen are the principal rivers flowing to the Arctic Ocean. The rivers are of considerable size—as already noted, the largest in Europe—and most of them have gentle slopes.

The Caucasus mountain range, a part of the continental boundary, forms a definite division between the steppe country to the north and plateau of Armenia to the south. The lowest pass over the mountains—the Daryal—is nearly 8,000 feet above the sea-level. The two highest peaks, Mt. Elbruz (18,500 feet) and Mt. Kasbek (16,500 feet) are extinct volcanoes. Like the Alps, the Caucasus are partly formed of limestone, and are thickly forested, especially on the southern side ; the slopes are permanently covered with snow above 9,000 feet. This range may be compared with the Pyrenees, for both are comparatively narrow, yet they have few passes, and are difficult to cross ; in each case railways pass round the ends of the range (though the Pyrenees are also crossed by rail about their centre). The Yalta mountains, on the Crimea, are probably the remains of a bigger range connecting the Balkan and Caucasus mountains. Like the Mediterranean, the Black and Caspian Seas have been caused by subsidences.

The Urals are a folded mountain range, stretching from the Arctic coast almost down to the Caspian depression ; although of great length, they do not rise above 5,500 feet. On the European side, they slope gently to the plain, on the other side the descent is abrupt. The lowest part of the range is a middle section, opposite Perm, where a railway crosses ; the highest part, the southern portion, where the Ufa valley provides a natural route for another railway, which unites with the line from Perm, at Cheliabinsk, to form the Trans-Siberian railway. The vegetation on the Urals changes from north to south as it does on the plain : the northern part is tundra (which, on the heights extends farther south than on the low plains) ; the central part, forest ; and the south is steppe. There are rich deposits of minerals.

*Climate.*—Over the great expanse of plain there are no mountains



to give protection against cold winds from the north and east in winter, and there is no moderating influence in summer. In winter the isotherms run from the north-west to the south-east, the line of  $15^{\circ}$  F. being roughly central ; but the temperature may vary from freezing-point in the west and south, to  $50^{\circ}$  below zero in the coldest parts. In summer the direction of the isotherms is from the south-west to the north-east, the line of  $68^{\circ}$  F. being about central ; but as in winter the temperature varies considerably, varying from  $45^{\circ}$  F. to  $80^{\circ}$  F., and rising considerably above the latter figure in a few places. The summer and winter isotherms cross nearly at right angles ; thus the coldest areas are in the north-east, the warmest in the south-west, the greatest range of temperatures being experienced in the south-east and east. Broadly, there is a gradual decrease in the annual amount of rainfall from the west to the north-east and south-east. Rain falls mostly in summer when the prevailing winds are from the west and north-west ; cold winds sweep the country from the east and south-east in winter, and bring snowstorms. In the distribution of rainfall and range of temperature Russia shows a strong contrast with Western Europe.

*Communications.*—Rivers, canals, and lakes provide nearly 100,000 miles of waterway, of which nearly a quarter can be used by steamers. The Volga and Neva are connected by canals ; the Dnieper is connected with the Dniester, the western Dvina, and the Vistula. The rivers are used largely for transport, and in many parts are the only means, there being large areas which the railways do not touch, and the roads are bad. The Volga is the best river for transport, but shifting sand-banks make navigation difficult ; the Dnieper has rapids at the bend, the Dniester is rapid, while the Don is shallow. The Volga would be more useful if it flowed to the Black Sea, where there are bigger trading centres than on the shores of the Caspian Sea ; besides, the Black Sea is connected by straits with the Mediterranean Sea, whereas the Caspian is an inland sea. Goods are trans-shipped from the Volga to the Don at the point where their courses approach each other, and carried to the Sea of Azov, an offshoot of the Black Sea. During the winter the rivers are frozen—those in the north for six months in the year. When the snows melt in spring, the rivers flood and vast areas become quagmires. Most of the rivers start from marshes or lakes, and owing to the absence of high

ground, have developed very large basins. Some marshes have been drained by artificial means, but this land has not yet been developed to any great extent. There are few good roads, owing to the lack of proper materials for building them. In winter the snow lies deep on them and sleighs are used ; in spring they become a mass of mud ; in the dry season mud changes to dust.

Russia possesses a comparatively small coastline in proportion to its area. Only a small part of the Baltic coastline belongs to Russia, and the only port here is Leningrad, standing at the head of the Gulf of Finland. The port is closed by ice during the winter. Owing to the sand-banks and shallows of the gulf, a ship canal, 18 miles long, has been made between Leningrad and Kronstadt, a port on the eastern end of Kotlin Island.

The White Sea, forming the most important part of the Arctic coast, consists of three bays, on one of which stands Archangel, the chief town of Northern Russia. This port, standing at the mouth of the northern Dvina, is closed by ice from October to May, but considerable trade passes through it, and there are good herring fisheries. Other rivers flowing into the White Sea are the Onega and Mezen ; the rivers are frozen from November to May, but the Onega and Dvina are used a great deal for transport during the rest of the year. On the Black Sea the chief port is Odessa, which is not so liable to be frozen as the river ports. Astrakhan, the chief Caspian port, is the centre of the fishing industry (sturgeon, &c.) of this sea and the Volga.

The railways converge on Moscow from all directions ; this city is the centre of the system. Lines lead in from the ports on the four seas ; these ports are Archangel, Leningrad, Kherson, Astrakhan, and Baku. Odessa is not well served by railway, but a line connects it with the Lemberg-Kiev-Moscow route. Warsaw is connected directly with Moscow and also with Leningrad. From Leningrad a line leads due east through Perm to join the trans-Siberian railway from Moscow, and another connects Leningrad with Murmansk, a port in the north of the Kola peninsula. Owing to the drift of warm waters from the Atlantic, this port is practically ice-free throughout the year, and it may prove to be of great importance to Russia. The lines for Asia divide at Samara : one line goes eastward to form the Trans-Siberian railway for Omsk, Tomsk, &c., the other through Orenburg for Bokhara.

*Natural Divisions.*—The climate has a marked influence upon the vegetation, and the different forms of vegetation enable us to divide the area into several great natural regions. In addition to the wealth of forests, and the products of rich agricultural lands, there are excellent deposits of minerals, but only partially developed; there are no manufacturing industries on the scale of those of western Europe.

*The Tundra* stretches from the Arctic Coast to about 65° N. lat. The few people who live here keep reindeer and are engaged in fishing and hunting. The most important part of the region is the lower basin of the northern Dvina, at the mouth of which stands Archangel. The chief industries are trading in furs and skins (ermine, squirrel, and wolf); the preparing of oil (from seals caught in the Arctic); the obtaining of timber, tar, and pitch from the forests which grow in the river basin. Archangel is a busy place during the summer months when the port is open.

*The Northern Forests (Taiga).*—Toward the southern margin of the tundra, trees appear, but owing to the severity of the climate they are dwarfs. These trees increase in size and in numbers to form large forests, the commonest trees being birch and fir. In the south-west and south, large areas have been deforested and the ground is cultivated, producing rye, oats, barley, and root crops. The natural resources of the forests are not fully developed. People are engaged in hunting, trapping for furred animals, and in forestry. Timber is floated down the rivers to the Arctic; by the Volga tributaries to the central and southern regions of Russia; by lakes and rivers to Leningrad. Tar and pitch, important products of the forest trees, are shipped chiefly from Archangel. Large quantities of timber are cut down for domestic use and to supply fuel for locomotives, factories, and smelting works. A little paper-pulp and paper are manufactured in a few places. The chief difficulties in the way of development are the poor communications, and the lack of outlets by sea. Leningrad lies in the western part of this region. Being the only port for trade with north-western Europe, it is important; but the port is distant from the industrial centres. Leningrad manufactures iron and steel goods, miscellaneous metal goods for domestic use, rubber goods and rope, but these industries are less important than formerly.

There are two coal-fields in this region, one to the south of Moscow,

the other in the Urals. Moscow, the capital and principal industrial city of the plain, is the centre of a textile industry ; other industries are engineering, the production of leather, hardware, and china goods and glass. In addition Moscow is the centre of the railway system of the plain. The iron and steel industry is centred at Tula, to the south of Moscow. Flax and hemp are grown in the neighbourhood of Moscow ; the flax fields stretch from Nijni-Novgorod, westward to the Baltic, and southward to the Sea of Azov.

The other coal-field lies on both sides of the Urals, Perm and Ekaterinburg being the chief towns. The eastern side is the more important, for in addition to coal iron is found. There are also in the Ural belt deposits of platinum, gold, silver, copper, and precious stones. Beside the two already named, other towns are engaged in iron and steel trades, producing railway stock, and agricultural implements. Another town lying in this region and also in the flax belt is Nijni-Novgorod, on the Volga, at the point where it is joined by its tributary the Oka. This town is famous for its summer fair to which merchants come from all directions—even from China—to sell their goods and buy from others. Then the river is crowded with boats.

*The Black Earth Region and the Steppes* include the great agricultural belt of the Russian plain. The Black Earth lands produce large crops of wheat, besides rye, maize, barley, oats, and sugar-beet. As in Poland, potatoes are grown in many parts for food and for the starch and alcohol industries. Flax and hemp, mostly on the Ukraine frontier, and tobacco in the Kozlof district, are also grown. Throughout the agricultural belt, stock-farming is carried on ; horses, cattle, pigs, and sheep all being important. In the Don country, the home of the famous Cossack horseman, the soil is less fertile, consequently stock-farming is the principal occupation, hides and coarse wool being the chief products. The Black Earth region, with the exception of the Moscow industrial area, is the most densely populated part of the Russian plain, but farming methods are poor. For orchard fruits and vegetables, grown mostly in the valleys, there is a market in the colder regions to the north. The greater part of this region forms the republic called the Ukraine ; the Don Cossacks have also a separate republic. In the Ukraine the greater part of the people are Little Russians (Slavs). A large

number of Jews are found in the industrial towns. Over 80 per cent. of the people are engaged on the land ; they are backward, probably not more than a quarter of the people being able to read or write. The manufacturing industries of the Ukraine are mainly those connected with agriculture : sugar-refining, flour-milling, brewing, distilling, and tanning are found in the large towns. There are several large towns, among which Kiev is the capital. The great port of the region is Odessa, from which the grain is exported. Nicolaief (Nikolayev), at the mouth of the Bug, is a serious competitor of Odessa. Both these ports, and Kherson, on the Dnieper, have flour-mills and shipbuilding yards. The Ukraine possesses the most valuable coal-field of Russia, that in the valley of the Donetz—a tributary of the Don ; on the coal-field and at Krivoi Rog, in the lower Dnieper basin, are valuable iron-fields. Large quantities of iron and steel are made, and coal is sent to Moscow and Leningrad. Salt is mined on the coal-field. This is a valuable mineral, for salted fish and meat form an important part of the diet of the people of Russia during the winter months, when other supplies are difficult to obtain.

The southern part of the Crimean peninsula, sheltered by the Yalta hills to the north, has a mediterranean type of climate, producing vines and fruits ; the northern part belongs to the steppe region. Sevastopol is a naval port.

*The region bordering the Caspian Sea* is mostly unfertile steppe and salt marsh, a few parts being true desert. The Kirghiz, horsemen of the steppe, live in this region ; they lead a nomadic life. Orenburg, the chief town of the region, is a trading centre to which pastoral products, such as wool, skins, and leather, are brought. Astrakhan has considerable trade and is a fishing centre (caviare is obtained from the sturgeon). It is a distributing centre for petroleum, brought from Baku (p. 217) by steamer ; for cotton from different parts of Asia ; and for wool produced in surrounding districts.

*People and Political Divisions.*—The people of the Russian plain are mostly of the Slavonic race : in the tundra and northern forests there are Lapps in the west and Samoyeds in the east. The Little Russians of the Ukraine are akin to the Great Russians, the people of Soviet Russia, but their languages differ. The Ukraine is more

densely populated than most parts of Russia; and large numbers have emigrated to North America. The people of Soviet Russia are mainly Great Russians. In the south-east there are Tatar tribes including the Kalmucks, Kirghiz, Tatars, and Bashkirs. Both these groups of people are of Asiatic origin. The Ukraine lies in south-west Russia, bordering Poland and Rumania, between  $46^{\circ}$  N. and  $53^{\circ}$  N. lat. To the east lies the Don Cossack republic. Soviet Russia includes the whole basin of the Volga and that part of the eastern European plain which drains to the Arctic Ocean. The peasants of Soviet Russia are very backward, the large majority being quite illiterate. Great Russia, White Russia, Tatar-Bashkir and Kirghiz, together, have a population of about 70 millions. All those republics of Europe and Asia which use the Soviet form of government belong to the Union of Soviet republics.

## V. EUROPE : MEDITERRANEAN AND BALKAN LANDS

*The Mediterranean Sea* separates southern Europe from northern Africa and from south-western Asia. It is entered from the Atlantic Ocean by the Strait of Gibraltar, which at its narrowest part is  $8\frac{1}{2}$  miles across. From here the sea extends 2,400 miles eastward to the coast of Syria (Asia). The sea is irregular in shape. This is due chiefly to the three great peninsulas of southern Europe which project into it. Islands, too, are many. In the west there are the Balearic Islands, Corsica, and Sardinia, together with Elba and others under the Italian coast. From the southern end of the Italian peninsula the island of Sicily stretches toward the coast of Africa. Malta and other islands lie south of it. Most of the coasts of the eastern Adriatic Sea and the Greek peninsula are fringed with islands, and between the east coast of that peninsula and Asia Minor the sea is dotted with them. To the south of the Aegean is the large island of Crete, and in the extreme east of the Mediterranean, that of Cyprus. These peninsulas and islands break up the sea into several parts, some of which have different names : the most important are the Adriatic Sea between Italy and the Balkan peninsula, and the Aegean Sea which contains the Archipelago. The eastern part of the sea, and the lands bordering it, are sometimes called the Levant : this word means ' rising ', that is to say, the part toward the sunrise, the east.

*Routes.*—In the Mediterranean region the British Empire includes Gibraltar and the islands of Malta and Cyprus, and there are special British interests in Egypt. One reason for that is found in the immense importance of routes along and across the sea. It forms a part of routes from the Atlantic, or from its own western parts, to the land round the Black Sea, Asia, and the Far East. For at the north-east corner of the Aegean Sea the strait of the Dardanelles opens out into the Sea of Marmara, and from this the strait of the Bosphorus leads into the Black Sea, which gives access to the rich wheat lands of Rumania, to Russia, and to the ports for the oil-fields of Rumania and the Caucasus region. At the south-east corner of the Mediterranean, the isthmus of Suez, which joins Asia to Africa, is crossed by the Suez Canal, which lets big ships pass

from the Mediterranean to the Red Sea ; and thence to the Indian Ocean for India, China, Japan, Australia, and other distant lands (p. 209). And the shores of the Mediterranean, especially on the European side, are reached by a series of important natural land routes.

Considering the big west-east stretch of the Mediterranean there are relatively few natural routes to and through the Mediterranean region. From Fig. 51 it will be seen that the main routes are these. Sea-gates :

1. The Strait of Gibraltar from the Atlantic.
2. The Dardanelles-Marmara-Bosporus entrance to the Black Sea.
3. The Suez Canal (not a natural route) from the Mediterranean to the Red Sea.

Land routes :

4. The Rhone Valley in France, with the port of Marseilles at its outlet.
5. The routes through the Alps. Those followed by railways are—
  - (a) the Mont Cenis route from France,
  - (b) the Simplon Route and
  - (c) the St. Gothard route, from Switzerland,
  - (d) the Brenner route from Germany,
  - (e) the Semmering route from Austria.

All these descend upon the northern plain of Italy (a) to Turin, (b) and (c) to Milan, (d) to Verona ; (e) leads to the port of Trieste. From Turin a line runs to Genoa, whence there is a route along the western side of Italy to Rome, Naples, and the south.

6. A route from Central Europe crosses the Danube at Belgrade, and follows the valleys of the Morava and Vardar south through Serbia to Salonika, the Greek port at the north-west corner of the Aegean, whence a railway continues south through Greece (Athens, &c.).

7. From route 6 a branch runs east from Nish through Bulgaria and by the Maritsa valley to Constantinople on the Bosporus.

8. Through northern Syria the easiest access is afforded between the Mediterranean and the Euphrates-Tigris basin.

9. The Nile gives access to Egypt and the African lands beyond.



## Europe : Mediterranean and Balkan Lands

*Highlands and Coastlands.*—The Mediterranean Sea is almost surrounded, and its divisions are marked off, except in the south-east, by mountains and highlands. The principal mountain systems, which border the sea on the north, are the Alps and the Balkans. These systems—with the Carpathians and Caucasus, were uplifted in the geological period known as the Miocene and Pliocene. With these earth movements were connected great volcanic eruptions and destructive earthquakes. There are still active volcanoes<sup>1</sup> on the eastern edge of the western basin—Vesuvius near Naples, the island of Stromboli, and Etna in Sicily—and in this part there are sometimes bad earthquakes. Some of the Aegean islands represent old volcanoes, and in various parts of the Mediterranean area there are hot springs.

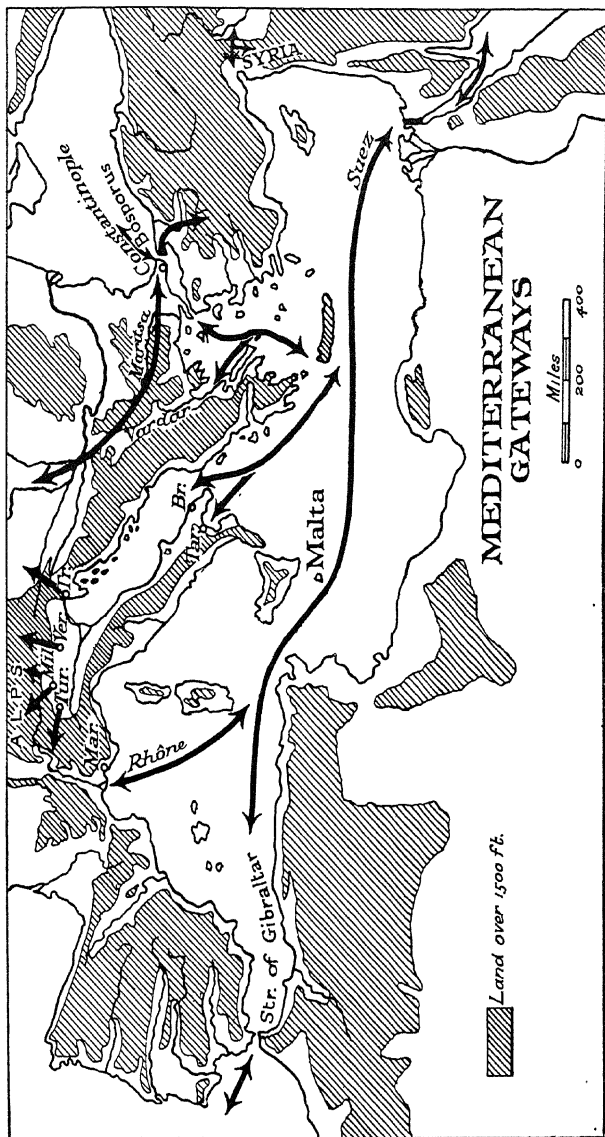
We have already mentioned limestone mountains in connexion with the Alps, and they are an important feature of the Mediterranean region, especially in its eastern part. Highlands, formed of limestone, appear in eastern Spain, in parts of the Apennines, along the eastern side of the Adriatic Sea (e. g. the Karst district) and right through the Greek peninsula. These limestone highlands are steep-sided and scored by deep gullies and gorges: they are thus serious obstacles to communication. They are bare and stony, and little soil is found except in basin-shaped depressions, where cultivation may be carried on.

The Mediterranean, being an enclosed sea, has no strong tides and seldom heavy waves; thus, where the coasts are low, they are often broken by creeks and river distributaries, because most of the silt brought down is allowed to remain. Banks are built up, some of which enclose lagoons (e. g. about Venice). But the presence of so much high land suggests that much of the coast is high and steep.

*Climate.*—As already pointed out, the Mediterranean type of climate differs in important respects from those of western and central Europe: these differences and the general nature of the climate have important effects upon the people who live in this region.

In summer northerly winds prevail. They are dry, and would be very hot if it were not for the cooling influence of the sea. Every-

<sup>1</sup> See further, Part II, p. 435.



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where the temperature increases away from the sea, unless at the greatest heights. In summer all the Mediterranean lands are dry and parched ; rain is rare ; sunshine almost constant during the day. In winter a succession of depressions, passing (generally speaking) along the sea from west to east, bring rain (Part II, p. 480).

Some parts of the Mediterranean region are subjected to high winds which are accompanied by particular kinds of weather. For example, in the western Mediterranean, a cold northerly wind which blows down from the mountains is called the *mistral* (masterful). In the Adriatic a similar wind is called the *bora* (from Boreas, the classical north wind). A southerly wind which blows across Sicily and southern Italy is called the *sirocco*. In summer it brings heat, drought, and dust (probably from the Sahara) ; in winter, it becomes moist as it crosses the sea and brings muggy weather.

With regard to temperature, we find generally that the eastern Mediterranean has hotter summers and cooler winters than the western part, and the west coasts of the peninsulas have warmer winters than the east coasts. This is due to the tendency of the larger expanses of sea to the west to moderate the extremes of climate. In August Lisbon has an average temperature eleven degrees lower than Athens ( $70^{\circ}$  and  $81^{\circ}$  F. respectively) ; but the average is two degrees ( $49^{\circ}$  and  $47^{\circ}$ ) higher in January. Some parts of the Mediterranean lands are famous as winter resorts for visitors from lands farther north. Such are the sheltered northern coast of the western Mediterranean in France and Italy, known as the Riviera, and, on the African side of the sea, Algeria and Egypt.

The amount of rainfall differs greatly. The heaviest known rainfall in Europe is recorded on the westward-facing coast of the Adriatic, near Kotor (Cattaro), averaging 183 inches a year. In south-east Spain the rainfall averages only 10 inches. Though winter is broadly speaking the wet season, over large districts, especially in the west, there is heavy rainfall in autumn or early winter, less in midwinter ; more again in late winter or spring. (Examples will be found in Part II, tables following ch. xv.)

The distribution of the true Mediterranean type and the variations from it, are as follows. The climate of a narrow belt along the east coast of Spain is true to type ; and so is that of the greater part of Portugal, except that the summer is cooler owing to the

influence of the ocean. The north coast of Spain has the west European type of climate, with equable temperature and rain at all seasons. The high plateau (Meseta) of Spain has extremes of temperature. The southern coastland of France and most of the Italian coasts as well as the southern slopes of the Alps have the Mediterranean type of climate. The low plain of northern Italy has greater extremes of temperature, and rain falls in any season. Over the Apennine part of Italy there may be extremes of temperature but the rain generally falls in winter. In the Balkan peninsula the typical Mediterranean climate favours the west coast, the Greek peninsula, and the north coast of the Aegean although the two last have rather colder winters. The whole interior of the peninsula, behind the mountains, has the central European type, with some rain at all seasons and very cold winters. Special features of the Mediterranean climate are the large amount of sunshine and the clear air. The rainfall is commonly very heavy for short periods, instead of being slight for long periods. One consequence is that watercourses, which may be dry or nearly so for part of the year, are sometimes subject to sudden high floods.

*Vegetation.*—Under the typical Mediterranean climate there flourishes a typical Mediterranean vegetation. There is only a short period during the year when the growth of plants is rapid. Long periods of dryness cause the plants to adapt themselves in various ways to keeping what moisture they get. Leaves are usually small, thick, and tough. Thorny plants are common, also oil-yielding plants, and plants growing from bulbs or tubers. Trees generally grow rather low ; their evergreen leaves are commonly dark or of a dull, greyish hue : the cork and other evergreen oaks, various pines and firs, the cypress, cedar, and olive are examples. The olive is extensively grown for its oil-yielding fruit. A rich growth of shrubs and bushes is common. They include laurels, myrtle, rosemary, dwarf palms, and many others. A dense scrubby growth, perhaps six to ten feet high, and sometimes difficult to get through, is characteristic of waste land in many parts, and is known as *maquis* (French) or *macchia* (Italian). Deciduous trees, such as oaks, are found, but where rainfall is fairly distributed throughout the year. On the hill-slopes, above 3,000 feet, these deciduous trees are more common ; in Spain and Italy the chestnut supplies an important

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food. Cedars also appear at high levels. Many trees and plants which are now important in the Mediterranean region have only been introduced there in historic times, such as oranges and lemons, and maize.

We find here, as in other parts of Europe, that many forests have been cut down. In central and western Europe, the deforested areas have become rich agricultural lands, but in the Mediterranean region this is not the case, for many tracts are now covered by *maquis*. Another result is that the soil, unprotected by trees, has been washed away by heavy rains, and the land spoiled.

*People.*—The Mediterranean region, divided as it is into a number of well-marked physical divisions, shows also a number of divisions among its inhabitants, with different characteristics. Among the European lands the Iberian peninsula—Spain and Portugal—is marked off physically to be the home of a people united in race, with the exception of the Basques, who live in the country bordering the south-east corner of the Bay of Biscay, on both sides of the Franco-Spanish boundary. The position of this people may be compared with that of the Bretons, and the Celts of Wales. They are an ancient people whose origin is unknown and they have preserved their original language. The Spanish and Portuguese are of one race but languages differ considerably in different parts of the peninsula. Italy is as clearly marked off as the Iberian peninsula, and the Italians are a united people, even though there is some distinction between the Italians of the Po basin and the people of the rest of Italy. The Balkan lands, however, are divided physically, and into different states, and between several peoples, as we shall find later.

The most densely populated parts of the Mediterranean region are found in the western half—along the east coast of Spain, in the Po basin of Italy and along both flanks of the Apennines, and in Sicily. The small island of Malta has also an exceptionally dense population. The only part where there is a large manufacturing population to be compared at all with the much greater industrial districts of Germany and Britain is in the Po basin of Italy ; but in other parts there is a very close agricultural population, for the agricultural lands themselves are of small extent.

## THE IBERIAN PENINSULA

## SPAIN

The range of the Pyrenees forms a barrier between Spain and France, and as communication across the narrow Strait of Gibraltar with Morocco is easy, the peninsula was in the past as much under African influence as European, and there is some reason in the often-quoted French saying that Africa begins at the Pyrenees.

In the peninsula we find great contrasts of climate. The mountainous north (Cantabria and the Pyrenees) has the maritime climate of western Europe, and in the north-west some parts have an annual rainfall of nearly 80 inches. Portugal, as we have already noticed, has the Mediterranean type of climate, modified by the ocean. The Meseta (plateau) together with most of the Ebro basin has great extremes of temperature—these parts are very hot and dry in summer, and cold in winter. There is greatest precipitation in winter, often in the form of snow. On the east and south of the plateau the climate merges into the true Mediterranean type of the coastal regions. As a whole, the country is not easy of approach from the sea, and the rivers do not afford great help as only the Guadalquivir is navigable for any distance. The north coast is high, steep, and rocky but there are a number of little bays which give small harbours. The north-west is also high but here we have the *ria* type of coast which gives good harbours. The coast of Portugal is comparatively low. Along the south coast there is a narrow coastal plain, and the hills of Algarve, which rise not far behind, end in the bold Cape St. Vincent. There are unhealthy marshes around the mouth of the Guadalquivir. At the Straits of Gibraltar rises the high, steep rock of that name. The rest of the south Mediterranean coast is generally steep and difficult, and the east coast of Spain continues alternately high and low, but nowhere much indented, so that good harbours are few.

The tableland of the Meseta occupies over two-thirds of the whole peninsula. Its average height is over 2,500 feet above sea-level. It is bordered on the north by the Cantabrian mountains and on the south by a series of ranges among which the Sierra Nevada rises to an extreme height (11,400 feet) exceeded in Europe only by

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the Alps. The highest point in the Pyrenees is 11,000 feet. The Meseta itself is crossed by a series of ranges extending in a general direction west and east. The Sierra Morena is really not a definite range, but represents the edge of the Meseta, where it falls steeply to the valley of the Guadalquivir. The term *sierra* (or *serra* in Portugal) refers to the saw-like edge characteristic of many ranges of the peninsula. The Meseta is highest in the east and north-east, and slopes gently toward the west, so that the largest rivers flow to the west coast, excepting the Ebro, whose narrow basin separates the Pyrenees from the Meseta. The names of two of the chief rivers, the Guadalquivir and Guadiana, most directly accessible from Africa, are of Arabic origin, the syllable *guad-* representing the word *wad* or *wadi* usually applied to watercourses in north Africa. The rivers of Spain have their chief value for irrigation, the rainfall being too small, and the dry season too long, to keep the soil moist without this help. The peninsula may be divided into the following natural regions—

- (i) The Cantabrian mountains and Galicia, which have the wet, cool climate of western Europe.
- (ii) The Meseta with its extremes of climate.
- (iii) The south of Spain, including the lowlands of the Guadalquivir, the southern slopes of the Sierra Morena and the range of the Sierra Nevada.
- (iv) The east coastal plains, with the seaward slopes of the Meseta, and the lowlands of the Ebro basin.
- (v) Portugal, where the more mountainous country of the north has a climate colder and wetter than the lowlands of the south.

The mountains of the north, wild and in parts snow-covered on the heights, have rich valleys on their flanks, with fine forests of oak, beech, and chestnut on the lower slopes ; while among fruit-trees the apple is so common that cider is the usual drink. This is the only part of Spain which has green meadows like those of England and France, and it is the most densely populated part of the country. The climate is favourable, and in addition there are vast deposits of minerals, the chief of which are iron-ore and coal. The chief coal-mines are found in the province of Oviedo. Iron-ore is found in the district behind the ports of Bilbao and Santander. These are the chief ports for exporting the ore to Great Britain.

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This region is suitable for cattle-rearing on the good grass-lands. Dairy cattle are raised chiefly here ; elsewhere oxen are used for ploughing and carting.

Rolling forested country appears in a few places on the Meseta, as about the head-waters of the Tagus. But the level parts of the plateau are largely unfertile and sometimes almost uninhabited. A poor steppe vegetation sometimes appears. The olive grows over the southern half of the plateau and towards the southern edge ever-green shrubs are found. Sheep are numerous on the plateau, but the fine-fleeced merino, which had its origin here, is less important than formerly. Sheep graze in the lower lands of the west during winter ; in summer they move eastward and northward into mountainous districts where the pasture is less parched.

The plateau is isolated from the districts surrounding it, and roads and railways only reach it by more or less difficult passes, especially on the north and east. The railways converge on Madrid, the capital of Spain.

Southern Spain has very warm winters and sub-tropical plants can be cultivated, but it is necessary to irrigate the land. In addition to native plants, others, such as the date-palm and banana, have been introduced. In those two regions the irrigation works are extensive and some are very old—Moorish or even Roman. They consist of canals constructed sometimes for long distances and carried with much skill along the sides of hills or on high aqueducts, from the sources of water in mountain-springs and streams, to reservoirs and networks of artificial channels through which the water is distributed to the agricultural plain lands.

In southern Spain oranges and lemons grow in abundance and the vine flourishes. Some of the wines are famous. Dried fruit such as raisins and plums, and almonds, chestnuts, and walnuts are produced. The olive is extensively cultivated both for its oil and for eating ; the chief centres for these two branches of the industry are Cordoba and Seville. Sugar-cane and sugar-beet are grown. The mulberry-tree grows but it is at its best in Valencia, and feeds the silk-worms which support the silk industry. Wheat and barley (which is used as fodder for horses and mules) are the chief grain crops. Most of the bulls specially bred for the national sport of bull-fighting are reared in the plains.



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There is great mineral wealth in this region. Iron-ore is found in the Sierra Nevada. Copper comes principally from the mines of Rio Tinto and others at the south-western extremity of the Sierra Morena ; lead from Murcia and the Jaen district of Andalusia ; silver from Almeria ; mercury from Almaden.

Cordoba and Linares are important towns but the greatest trading town is Seville, on the Guadalquivir about 70 miles from its mouth. Cadiz commands the mouth of the river, but Seville has become more important because of its industries ; it possesses iron foundries as well as cork and other industries.

The Mediterranean fringe consists for the most part of a narrow coastal plain, but it also includes the slopes of the hills which rise up behind. The hillsides have been carefully terraced. There is little natural soil here, but years of cultivation have made these lands the most productive in the whole country. The vine and olive grow easily, and other crops are cultivated by irrigation. Oranges and lemons are raised in large quantities. Rice is grown in the low-lying marshes of Valencia. On the south-eastern steppes, esparto grass is grown ; it is made into paper and mats and used for many other purposes, such as basket-work and hat-making.

In this region we find the greatest sea-port and industrial town of Spain—Barcelona. This town and the towns around it are engaged in cotton, linen and woollen, and other manufactures. The lowlands of the Ebro basin do not belong to the Mediterranean region proper, for the winters are colder and the climate is intermediate between that of the Meseta and the Mediterranean region. The lower temperature prevents the growth of oranges and lemons, but olives, vines, and cereals can be grown. Saragossa, the chief town of the region, is engaged in the refining of sugar and has iron and steel works.

Spain has not many great manufacturing industries. The manufactures are found mostly in coastal districts, where coal, machinery, and raw materials can be most easily obtained ; although fairly important manufactures have grown up in Madrid since that city became the capital. The northern districts are most favourably situated for manufacturing industries, for there the climate is more temperate and water-power is available. The economic development of Spain has been slow. Over the greater part of the country the

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soil is poor and rainfall is lacking ; the physical character of the country hinders communication ; the political conditions have been against development. Spain is probably richer in minerals than any other European country. Mining has been developed largely by foreign enterprise, and especially British, but might be extended. Minerals take first place in value of exports and fruit ranks next in importance, with wine third. Other exports are cotton goods, olive oil, cattle and hides, cork, and esparto grass. The chief imports are raw cotton, coal, chemicals, machinery, woollen goods, wheat, fish, and timber.

*The Balearic Islands*, in the Mediterranean Sea east of Spain, to which they belong, consist of three chief islands—Majorca, Minorca, and Iviza—and a dozen smaller. They are hilly, with heights of over 5,000 ft. in Majorca. Climate and vegetation are typically Mediterranean ; the islands are fairly fertile though water has to be preserved in great reservoirs against the dry summer. The people trade in fruit, grain, wine, oil, and fish.

### PORTUGAL

The most densely populated areas in the Iberian peninsula, excepting Madrid and its neighbourhood, form belts between the margins of the plateau and the coasts ; and in Portugal the western half, toward the coast, is the more populous.

Northern Portugal is generally hilly ; much land is uncultivated, but there is a good deal of pastoral farming. The vine is grown in all parts of Portugal, but it is here in the Douro valley that the most famous wines are produced. The harbour of Oporto is the outlet, and hence is derived the name of port for the wine chiefly made. In southern Portugal there are more extensive plains than in the north, and rice, oranges, lemons, figs, and almonds are grown. The chief plantations of the cork-oak are in the lower valley of the Tagus, and it grows widely south of that river and extends into southern Spain. The raw cork is sent to Lisbon to be prepared for export. Lisbon, the capital and chief port of Portugal, stands on the Tagus where the river broadens into a beautiful land-locked basin. There are ironworks, ship-building, and other industries.

The vegetation in some parts of Portugal, where heavy rainfall is combined with mild temperature, is perhaps richer than anywhere

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else in Europe, plants characteristic of north-western Europe, the Mediterranean region, and tropical latitudes being found together. Minerals are not lacking. These natural features suggest a country which though small has good resources, but they are not fully developed. The principal export is wine ; others are cork, cattle, copper, fruits, sardines, and salt.

### ITALY

The kingdom of Italy consists of the peninsula of Italy, the islands of Sicily, Sardinia, and Elba, and a large number of smaller islands. The structure of Italy may be very simply illustrated thus : in the letter S the top curve represents the Alpine region ; the middle of the letter represents the mountain system of the Apennines, which occupies most of the peninsula, and curves through its ' toe ' at the bottom of the letter, the line of the curve being continued through the island of Sicily. Within the top curve there is enclosed the basin of the Po. This plain and the Alpine territory to the west and north of it, together with the territory of Istria on the east side of the Adriatic, may be reckoned as continental Italy, as distinguished from peninsular Italy.

The boundary line between Italy and France follows, for the most part, the crests of the Maritime, Cottian, Graian, and Pennine Alps. Mont Blanc, the highest Alpine summit (15,800 ft.) is on the frontier, and so is Monte Rosa (15,200 ft.). The boundary with Switzerland runs south of the high crests and cuts across the valley of the Ticino and the lakes Maggiore and Lugano. Farther east it follows the great heights again so as to give Italy the southward valleys, including that of the Adige which leads to the Brenner Pass. The Italian Alps thus include the Ortler (12,800 ft.) north of Lake Garda, the famous sharp-peaked Dolomites on the other side of the Adige, and other high groups. The Italian Alpine belt, except at the Ticino valley, is thirty to fifty miles wide in the west, and increases to 120 miles between the Brenner Pass and the plain. The boundary then runs to the Adriatic coast, close to Fiume.

Above Savona, a low pass called the Colle dell' Altare is taken to separate the Ligurian Alps from the Apennines. From here the Apennine system extends right through peninsular Italy. The northern part of the system borders the basin of the Po on the south,

so that it crosses the peninsula from west to east and runs along the east coast to the north and south of Ancona. In this part of the system (on the 44th parallel) lies the little independent republic of San Marino. The central Apennines curve south-eastward from this neighbourhood and the line of their greatest heights runs parallel to the Adriatic coast ; they reach 9,000 ft. in the Gran Sasso d'Italia.

In peninsular Italy there is a comparatively small amount of lowland. The Apennines cover the greater part of it, but on the west, between lats.  $44^{\circ}$  and  $40^{\circ}$  N., lies the country sometimes called the Apennine foreland. In the south-east, where the Apennines curve away from the Adriatic coast, we find another foreland, comprising the plains and chalk downs of Apulia. To the north of these is the limestone height, detached from the Apennines, of Mount Gargano, which forms a kind of spur on the boot-form of peninsular Italy.

The coast of Italy is 4,000 miles long, and few large towns even in continental Italy are over seventy miles from the sea. In the north-west, the Riviera coast enclosing the Gulf of Genoa is mountainous. From Spezia to the Gulf of Gaeta north of Naples the west coast is low and marshy, except where it is broken by high promontories. Farther south it becomes steep and high. A number of islands lie off it : Elba is the largest, and Capri, south of Naples, is famous for its wonderful limestone cliffs and caves.

The east side of the toe of Italy, like the west, is closely backed by mountains. The east coast is more regular than the west and is almost without natural ports. The coast of the Po basin is so low that sea and shore merge in a maze of banks and lagoons, on either side of the mouths of the Po, between Ravenna and the Gulf of Trieste.

We have already observed the great difference of climate between northern (continental) and southern (peninsular) Italy. The plain of the Po is liable to be very cold in winter, with cold winds from the Alps, while the Apennines are shutting off from it the warmer airs from the Mediterranean. On the other hand it may be hotter in summer than the south of Italy because the Mediterranean influence in moderating the heat is withheld. Thus Milan has extremes of heat in summer greater than those of Naples ; but

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the winter temperature may average as low as that, for example, of a country so far north as Denmark.

Throughout the peninsula, strong contrasts of temperature are found within a few miles, according to the height of the land. These differences affect the vegetation. Thus in the Po basin olives, oranges, and lemons can only be grown in rare sheltered spots ; elsewhere no plant which cannot stand hard frosts will flourish for long : but just across the low hills, on the Ligurian coast, olives, oranges, lemons, cactus, and palms grow richly. In the south, too, in a very short distance, we may pass from the shore zone where all Mediterranean plants, date palms, sugar, and cotton flourish, up through the belts of oak and chestnuts, firs and pines, to grass-land which is not scorched by summer heat, as it is at the lower levels, for instance, in the Apennine foreland and Apulia.

*The Volcanic Belt.*—The Apennine foreland is broken at several points by old volcanic hills and tracts of old lava, and the still active volcano of Vesuvius rises boldly from the shore of the bay of Naples, south of the city of Naples. By an eruption of this volcano the Roman towns of Herculaneum and Pompeii, at its foot, were buried, and excavations in modern times have revealed wonderful memorials of the period of the Roman empire. The line of weakness in the earth's crust, shown by these volcanic signs, is continued southward, where Stromboli in the Lipari Islands and Etna in Sicily are active volcanoes, and earthquakes have often occurred. (See further, Part II, pp. 434-5.)

*Population.*—Italy as a whole is densely populated: most densely in fertile areas between the Alpine lakes and the river Po, and also in the east of the northern plains, around Genoa and in the lower Arno valley in the north-west, and around the bay of Naples, including the lower slopes of Mount Vesuvius (Part II, p. 438). Rome, the capital, is not in a thickly populated district. The low coastal plains hereabouts, and other lowlying wet tracts in southern Italy, were breeding-places for the mosquito which carries malaria to man, to such an extent that many such tracts were almost uninhabitable ; but much has been done to improve them. In some parts of Italy the conditions of life are poor, and many Italians have emigrated, as for example to the United States, Argentina, and Brazil, and to Britain.

*Towns.*—The northern plain illustrates the common position of towns at the outlets of mountain-valleys to a plain ; Turin, Milan, Verona, and others command routes from Alpine valleys; Parma, Bologna, and others stand along the foot of the Apennines. Other towns stand centrally in the plain, as where tributaries join the river Po, or where the river itself is bridged. Venice on islands of the Adriatic shore is a wonderful city whose main streets are canals. The lagoon in which the islands stand is shallow, and Venice is no

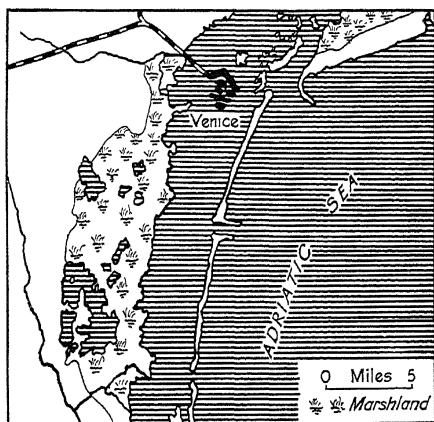


FIG. 52. THE POSITION OF VENICE on islands in a lagoon protected by sand-banks and merging into the marshy mainland.

longer the great port it used to be, because big modern ships cannot enter; Trieste (p. 140) takes its place, with a deep harbour at the foot of the hills on the north-east shore of the Adriatic. Genoa, however, approached by a low pass through the Apennines, is the chief port for the northern plain of Italy. The coasts of central Italy are lacking in natural harbours and nearly all the important towns are inland: in southern Italy all the most important towns are ports. In central Italy, Florence stands where the Arno valley is crossed by a line of communication north and south along a depression which marks off the Apennines from the western foreland. Perugia is in a central position in the valley of the Tiber which provides a route from Rome through the Apennines and so to

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the east coast and the northern plain. Rome itself stands on low hills above the lower Tiber, where the river is easily crossed and the coastal lowlands give a natural route north-west and south-east. Naples has become a great port and trading centre for the fertile district surrounding it.

*Agriculture and Fishery.*—The principal grain crops are wheat and maize. Macaroni made from flour is a well-known Italian manufacture. The vine is grown everywhere in suitable places ; the best

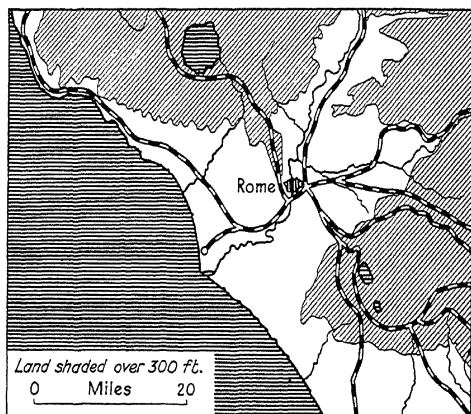


FIG. 53. THE POSITION OF ROME.

known Italian wines come from some of the slopes of the northern Apennines. The olive becomes of principal importance south of Rome, and there are many olive oil mills. Lemons, oranges, and limes flourish chiefly south of Naples and along the Riviera coast. The mulberry tree is grown in all parts, and silkworms are fed on its leaves. Dairy-farming is carried on largely in and around the northern plain, and well-known cheeses such as Gorgonzola are made. The fishing industry is large, and its products include sponges and coral.

*Manufacture.*—The Italian peninsula is not rich in minerals, though certain mineral products come from the islands—iron from Elba, sulphur from Sicily, lead and zinc from Sardinia. Coal is

wanting, and water-power, especially from the Alpine tributaries of the Po, is important ; while at some points on the Apennine foreland even the power of volcanic steam from the earth has been applied to industry. The chief manufacturing districts are in the

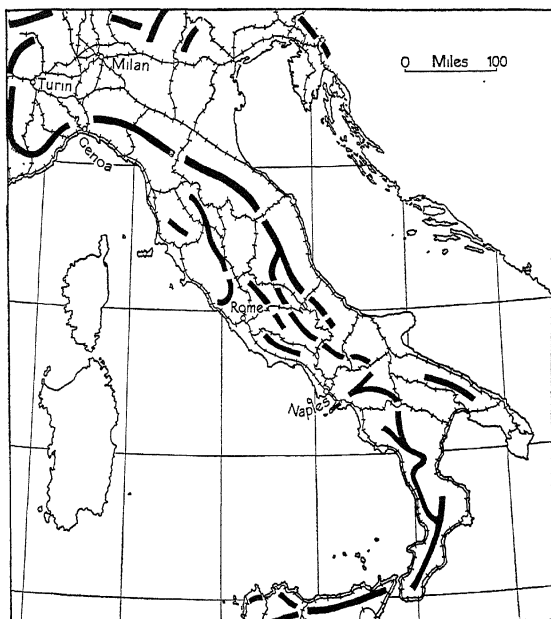


FIG. 54. The main railways of Italy, in relation to the main chains of the Apennines and bordering hills (a guide to the atlas map).

northern plain, where, for example, Turin has big mechanical workshops, notably for motor-cars. Another manufacturing district centres upon Naples. The production of raw silk and the manufacture of silk goods, are, among other textile industries, specially characteristic of Italy. Straw-plaiting, by country-women in their homes, and the manufacture of hats in factories from the plait, is another such industry. Some parts are famous for beautiful artistic products, such as Venetian glass, Florentine pottery, Roman



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jewellery and small ornaments (made of coral, lava, &c.). Silk and silk goods make up a quarter or more of the total value of Italian exports, and cotton, hemp, wine, motor-cars, sulphur, olive oil, and fruits are other important articles of trade.

*Communications.*—The relation of the main railway routes with the relief of the land in Italy is particularly useful to study as an example. The lines principally to be observed are those which enter the country along the Riviera coast and through the Alpine valleys ; the west-to-east connexion through the plain, those running southward, west and east of the Apennines, and the crossings of the Apennines. Fig. 54 gives a key to them.

*Sicily*, the largest island in the Mediterranean, forms a triangle separated from the ' toe ' of Italy by the Strait of Messina, which is only two miles across at its narrowest part, but is deep, and forms an important sea-way for ships from west-Italian ports to the eastern Mediterranean and beyond. A mountain-range from 4,000 to 6,500 ft. high continues the southern Apennines through the north of Sicily, making the north coast steep, with sheltered harbours. Around the south-west and middle-eastern parts of the island the coasts are generally lower and smoother and there is a greater extent of lowland. The low plain of Catania opens to the east coast, and north of it the volcano of Etna rises to 10,900 ft. from a base about eighty miles round. On the eastern side its outpourings of lava form cliffs towards the sea. Much fertile and highly cultivated land on its slopes have been destroyed by eruptions.

Sicily is very thickly populated. One result is that much of the population is poor, and there has been a great deal of emigration. A second is that the island is closely cultivated and there is little natural forest left. The slopes of the northern mountains are covered with orange, lemon, and olive groves up to 2,500 ft. or more ; while vines and wheat grow up to more than 3,000 ft. Of minerals, sulphur is the most important ; asphalt is another ; both are volcanic in origin. A large number of Sicilians are fishermen. The chief town is Palermo.

*Sardinia* is a mostly mountainous island, with heights up to 6,000 ft. ; but a narrow lowland extending from the middle of the west coast to the south-east divides the main mountain system from another, smaller, in the south-west. Although some parts of the

island are fertile and grow the usual Mediterranean products, most of it is rocky wild, and desolate. The lowlands suffer much from malaria. The inhabitants show the usual results of isolated life on a mountainous island. Except where they are most closely in touch with outside influences, they speak dialects so different as not to be understood even between one district and another; they also wear characteristic costumes, which again differ from one district to another.

The south-west of the island is fairly rich in minerals, producing chiefly lead and zinc; but the rugged and inaccessible character of the island has been against its development. There are rich fisheries off the coasts, but they are worked mostly by Italians.

*Corsica*, which belongs to France, is a mountainous island about half the size of Wales. The mountain ranges separate one district from another, and the people are thus divided into groups or clans. This, and the fact that the island lies away from the main sea-routes, account for the backwardness of the people. The forests of Corsican pine, oak, chestnut, and beech are valuable, but have been cut too much, and thick *maquis* covers a good deal of the land. There are a few minerals, but the exports are principally timber, charcoal, and other forest products, and fruits.

*Malta*, a British island less than twenty miles long and eight in greatest breadth, commands the passage between the western and eastern Mediterranean. It has a fine harbour, on which Valletta (the capital) and other towns stand. It consists of limestone, dry and porous, light of colour, and glaring in the sun; and trees are very few. Water is reached in wells, or stored in tanks, or carried from springs by aqueducts, for there is none on the surface. The island yields wheat, barley, and fruits (oranges, figs, &c.), and exports early potatoes, and other vegetables to places where they only mature later. The island is very densely populated and it is not self-supporting in production generally, so that the people are poor and there is much emigration. There is considerable trade in connexion with the garrison and naval establishment and with supplies for ships calling.

## THE BALKAN LANDS

*The Balkan Peninsula* is usually taken as the country south of the Kulpa, a southern tributary of the river Save, the Save itself, and the Danube downward from the point where the Save joins it. The states which lie mostly or wholly south of that line are known as the Balkan States (Yugoslavia, Albania, Greece, Bulgaria, Turkey in Europe). A map shows that most of the peninsula is mountainous, and the Danube and Save mark it off very clearly from the plains to the north. On account of its mountainous character, the difficulty of communication through it, and the mixture of races, languages, and religions among its peoples, the peninsula has been often a land of strife, and its economic development backward.

Except along the north of the Aegean Sea and the Black Sea the coasts are generally high and steep. The Dinaric and other mountains form a system of parallel ranges along the north-western side of the peninsula, continuing the folds of the Alpine mass. Their direction is from north-west to south-east, roughly parallel to the eastern Adriatic coast. Partly sunken ridges form a chain of high islands fringing this beautiful coast, and the coastal belt of the mainland is very narrow, and has few valleys opening upon it from the interior. The higher parts of the ranges are mostly of limestone, and in the north is the Karst plateau (p. 162). Cultivated lands are found in depressions between the ranges. The people of this region live either along the coasts or in these basin-shaped depressions, which are separated by high, steep mountains. The people thus tend to be separated in small groups, and some of the inhabited lands are very difficult to get at, so that government of this country is difficult.

The mountain ridges are continued through the Greek peninsula, but as they proceed south, the direction of the folds is more south-easterly, so that they tend to cross the peninsula. One of the folds, higher than the rest, forms a main range. Its middle part, which rises to 7,800 ft., is called Pindus. It sends off branches to the east, two of which enclose the Thessalian plain. From the northern edge of this and from the Aegean coast, the famous Mount Olympus rises to 9,800 ft. Between Mount Olympus and Mount Ossa (to the south) lies the Vale of Tempe, through which runs the Peneius river,

draining the plain. The only railway connecting Greece with the European railway system passes along this valley. Othrys, a broad range of easy slopes, grown over with oaks and *maquis* scrub, borders the Thessalian plain on the south and separates it from that of Lamia in the valley of the Spercheius. From the head of this the main mountain system of the peninsula runs south-east in steep ranges broken by wild gorges, with such heights as Mount Parnassus (8,000 ft.) and others higher. Narrow plains are found in the valleys to the east. The mountains fall south-eastward to lower heights in the peninsula of Attica, in which is situated Athens, the capital of Greece. Lowlands and valleys break up the ranges, and the peninsula ends in the rugged hills of Laurium, the richest mineral district in Greece. South-eastward from the seaward end of the Othrys mountains, and close off the coast, lies the long island of Euboea. It has forested hills and fertile valleys in the north ; the centre and south are higher and mostly barren.

The main range of the Pindus is a country of cliffs and gorges, and crossed by a few difficult paths which provide the only communication (except by sea) between the east and the west of this part of the Greek peninsula. The country west of the main range consists of lower ranges formed chiefly of limestone, which is bare and dry, but there are considerable tracts of sandstone with trees and running streams. The lower valleys of the rivers are sometimes marshy but otherwise fertile, and contain most of the population of this district. The most extensive plain is that of Arta, which borders the gulf of that name.

The peninsula of the Peloponnese or Morea is joined to the rest of the Greek peninsula by the isthmus of Corinth, which is less than four miles wide at its narrowest part. It is crossed by the Corinth canal between the heads of the Gulfs of Corinth and Aegina, where it is low.

The Peloponnese is generally mountainous, the highest points reaching to nearly 8,000 ft. The peninsula throws off a long promontory to the east (Argolis) and three to the south. These promontories consist largely of limestone, which forms steep cliffs facing the sea. The few people living here are almost completely cut off from the rest of the peninsula, and in the promontory ending in Cape Matapan the inhabitants live in fortified houses because the vendetta is still practised among them as in the wilder parts of Corsica.

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In this limestone region the rivers flow mostly underground, and water is obtained from wells or stored in cisterns for use during the dry summer. The whole eastern part of the Peloponnese tends to be dry, and the richest parts are found in the coastal lowlands of the west and north. Here chiefly flourishes, up to a height of about 1,000 ft. above sea-level, the small-fruited vine which yields currants, the principal export of Greece. The name 'currant' is a corruption of Corinth.

The central mass, lying between the Dinaric system and the Balkan Range, is not formed of definite mountain chains; it is a very ancient plateau area worn down by erosion, with deep valleys carved out by its rivers. Some of the mountains still rise to great heights (nearly 10,000 ft.); some are of volcanic origin, the Rhodope being made up largely of lavas. This central mass takes the form of a wedge pushed up between the other two systems. The apex rests on the Save river at Belgrade, and the base stretches across from the Gulf of Salonika to the south-western shore of the Black Sea. In the centre of the country the rivers have cut deep narrow valleys, but in the south-east and south, the work of erosion has been more complete, the valleys are open, and broad flood plains have been formed. These river basins and plains are covered with fertile deposits and naturally are the centres of population. In the Maritza valley the towns of Philippopolis and Adrianople stand at points where the plain broadens out; Nish, Sofia, Skoplje (Uskub), and other towns stand in river valleys; Salonika stands near the mouth of the Vardar river. The east coast of the gulf of Salonika is formed by the peninsula of Chalcidice, which is something like the Peloponnese on a small scale, being mountainous, and throwing off three high promontories to the south-east, separated by two long gulfs. The whole peninsula is marked off from the mainland by a depression partly filled with lakes. From the mouth of the Vardar to that of the Maritsa extends a narrow foreland, partly low plain and partly hills, called Macedonia. To the north are the rugged mountains of Rhodope, which are very difficult to cross. This foreland, therefore, has long formed a natural line of communication east and west between sea and mountains: the Salonika-Constantinople railway follows it now.

*The Balkan Range* is a continuation of the Carpathians, the two

ranges being separated by the Danube at the Iron Gates. From the Danube the range runs southward and eastward. The structure of the mountains is somewhat similar to the Alps, as there is an axis of old crystalline rocks ; this axis is fringed, more particularly on the northern side, by limestone mountains. The highest point of the range is less than 8,000 ft., but there are no low valleys cut transversely by the rivers. A large number of rivers flow down the northern slopes, but they are of no great size because they have only a short distance to go before joining the Danube. Roads follow some of these river valleys, but there is only one important pass—the Shipka—and this is 4,400 ft. high.

*The Aegean Islands* are arranged, at least in part, in chains which suggest sunken ranges of mountains connecting those of Greece and Asia Minor. The deep Cretan sea is bounded on the north by a chain of volcanic islands : none is active, though hot springs are found, and the volcano form is well seen in the islands of Milos and Santorin, broken circles of high land with deep sea inlets representing the old craters. Farther north a ring of islands surrounds Delos, and of these the northern form a chain between Euboea and Asia Minor. All these islands north of the Cretan Sea are called the Cyclades (‘ grouped ’ or ‘ clustered ’ islands), except those toward the coast of Asia Minor which are called the Sporades (‘ scattered ’ like seed), of which a group of twelve north-west of Rhodes are called the Dodecanese (‘ twelve islands ’). North-east of Euboea are the Northern Sporades, and in the north-east of the sea are several larger islands—Lemnos, Imbros, Samothrace, and Thasos ; with Tenedos, Mitylene, and Chios close off the northern half of Asia Minor. The islands are usually high and steep : they make the scenery of the Aegean beautiful, but its navigation difficult, although they have many natural harbours.

*The Ionian Islands* rise off the west coast of peninsular Greece : the chief of them are Corfu, Cephalonia, and Zante. Like the Aegean Islands, they are mountainous.

*Climate.*—We have found already that the only parts of the peninsula which have the Mediterranean type of climate are the west coast, the Greek peninsula, and the north coast of the Aegean Sea ; and in the case of the two last the winters are rather colder than those of the usual Mediterranean type. The interior of the

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peninsula has the continental type of climate. There is no sharp change from one type to the other, although in some places the mountains form a definite climatic boundary.

In the east and centre, the Black Sea has a strong influence, and these parts get their rains in summer from the winds which blow from this sea. The greatest rainfall is on the west, during winter and autumn ; and toward the east there is a gradual decrease in the annual amount of rain. In the south, the western side of each peninsula or island gets more rain than the eastern. Whereas the regions with Mediterranean type of climate get warm winters and hot summers, the north-east has cold winters and warm summers, like Hungary and Russia, because the winds which blow from these countries are cold in winter and warm in summer ; so that the climate of the Balkans is transitional between that of the Mediterranean region and the continental type such as is found in Russia.

*Inhabitants.*—The political division and the division of peoples are not the same. The mixture of race in the Balkans is due largely to movement of peoples from Asia. A natural route from Asia to Europe is across the narrow straits in the south-east, consequently this region became a gateway to Europe. We have already referred to the separation of the northern Slavs from the southern Slavs by the Magyar people in Hungary. The southern Slavs form the two states of Yugoslavia (that is the southern-Slav land) and Bulgaria. In the same way that the Magyars settled among the Slavs of Hungary, the Bulgars (like the Magyars, a people of the Turki family) settled among, and conquered, the Slavs of Bulgaria. The population of purest Slavonic origin is found now in the mountainous districts of the west, where they have been largely protected from later immigrants. The Albanians, who live in the mountainous country bordering the southern end of the Adriatic, have not lost their characteristics. The Greeks inhabit their peninsula, and spread over the Aegean Islands and along the north coast of that sea. But here there is much mixture of peoples, because that strip of coast forms a highway east and west. There are Serbs, Bulgars, and others, and lastly Turks. The Christian inhabitants of the Balkan lands do not all belong to the same church, and the Turks brought in Mohammedanism. There is little wonder,

with all this division, that the Balkan lands have been the scene of frequent wars.

*Communication.*—The most important railway system of the peninsula is that which connects Belgrade with Constantinople in the south-east (called the Orient line), and with Athens in the south. From Belgrade, which stands at the junction of the Save and Danube rivers, the railway ascends the valley of the Morava to Nish, where the line branches. The more important branch goes up the Nishava river—a tributary of the Morava—to Sofia, and by means of a fairly low pass it descends into the valley of the Maritsa. The railway passes through Philippopolis and Adrianople, and turning eastward runs across the plain of eastern Thrace to Constantinople. The other line continues from Nish along the valley of the Morava and crosses the mountains to Skoplje (Uskub), which stands on the Vardar river ; it descends this valley to Salonika. From this port a railway runs southward, passing through the Vale of Tempe to Larissa on the Thessaly plain and so on to Athens. We have mentioned already the railway connecting Salonika with Constantinople, and there is another line running north-west to Monastir. Two lines connect the Berlin–Constantinople line with the Black Sea ports ; one from Sofia crosses the Balkans by means of the Isker valley to Varna, the other connects Philippopolis with Burgas. It will be seen that the chief rivers within the peninsula are important because the railway routes run along their valleys ; they are almost useless for navigation.

*Yugoslavia.*—This kingdom includes most of the eastern Adriatic coastlands ; but here Italians and Slavs mingle, and Italy, besides the port of Trieste, possesses also those of Pola, Fiume, and Zara. In regard to production Yugoslavia has variety enough, from the Mediterranean products of the coastlands through the pastoral uplands and agricultural basins of the mountain belt, to the cultivable lands in the Danube basin south of the Hungarian plain ; again, the valleys of the Morava and Vardar in the east are fairly rich, and the surrounding hills with their beech and oak forests provide feeding-ground for herds of pigs. Besides the ordinary crops, and also tobacco, and mulberry trees in connexion with a silk industry, a special cultivation is that of plum trees ; the plums are dried as prunes and spirits distilled from them. Prunes are among the chief



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exports, along with timber, livestock, eggs, &c. The mineral wealth is greater than appears, but some coal, iron, copper, and lead are worked, and there are signs of petroleum. The country as an independent state is young and undeveloped, and the difficulties of communication between its different parts are against it. Belgrade, its capital, is a centre of routes along the rivers Danube, Save, Theiss, and Morava, but access from it to the Adriatic coast division is not easy, nor are the ports on that coast easily reached from the interior. A part of the Greek port of Salonika on the Aegean Sea, however, is free to Yugoslav trade.

*Albania*.—The Albanians through many centuries kept independent, thanks to the difficult approaches to their mountainous land : not only so, but their own various clans are isolated, differ in religion (some being Christians, some Mohammedans), and are sometimes at enmity.

*Greece*.—Of this wild, beautiful land only about a fifth is cultivated, and an eighth forested. In the east, especially, there are wide tracts of bare dry limestone hill-slopes, growing, at the most, only *maquis* scrub. The chief agricultural districts in the Greek peninsula are the plains of Thessaly ; some of the eastern valleys and in particular the drained bottom of a former lake, Copais ; and the coastal lowlands of the west and north of the Peloponnese. Cereals, cotton, and tobacco, olives, oranges, and lemons are grown, and, in the Peloponnesian lands especially, the vine which yields the small grapes dried as currants. The Ionian Islands, lying on the western side of the peninsula toward the more open sea, and better watered than the eastern side, are fertile and populous, growing olives extensively. The foreland along the north coast of the Aegean Sea, in the districts known as Macedonia and Thrace, have an important cultivation and trade in tobacco. Most of the Aegean Islands are Greek ; they have fisheries and a few minerals are worked, such as emery in Naxos and magnesite (used in the lining of furnaces, &c.) in Euboea, with some coal. On the mainland, the Laurium (Lavrion) district yields iron and silver-lead. About two-thirds of the population of Greece live by agriculture ; of the rest a large proportion are sailors and fishermen—naturally so, since so large a part of the population live along the sea-inlets of the mainland and on the islands : for the same reason, there are Greek traders scattered

all over the eastern Mediterranean lands. Most of the towns are seaports ; the capital, Athens, is not, but stands four miles inland from Piræus, its port. This and Salonika are the two chief ports. Among the chief exports are currants and other fruits, olive oil, tobacco, and wine.

The island of Crete, south of the peninsula, is Greek, though the population is mixed, and here again the Christian and Mohammedan

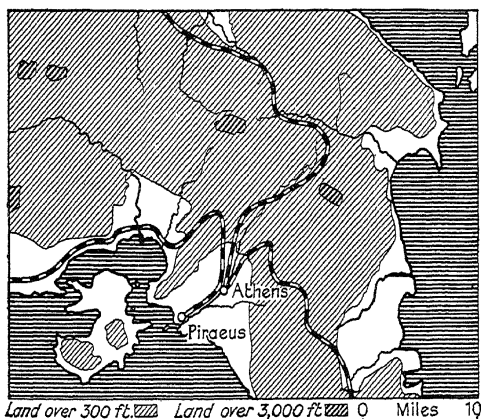


FIG. 55. THE POSITIONS OF ATHENS and its port of the Piræus.

religions meet. There is, however, a recent movement, not only here but elsewhere in the lands surrounding the Aegean Sea, of Mohammedans to Turkish territory—Asia Minor—and of Christian Greeks from that territory back to Greece. Crete is most famous for the remains which have been discovered of the buildings and the arts of a very ancient civilization, called the Minoan, which arose between two or three thousand years before Christ.

*Bulgaria* is divided into alternate belts of highland and lowland. The northern boundary with Rumania is the Danube, except in the Dobruja to the east. The Bulgarian bank of the river is high, except where tributaries from the Balkan Range have their confluences. The Danube flows along the edge of the plateau, which rises gradually up to the mountains. The plateau has been deeply

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dissected by the rivers. South of the Balkan Range is the fertile plain of the Maritsa valley.

To the south again is another belt of highland, formed by the Rhodope mountains, through which runs the boundary with Greece. In the west of the country there is a series of high basins, in one of which Sofia, the capital, is situated ; the Isker, a tributary of the Danube, drains this basin. As already explained Bulgaria does not

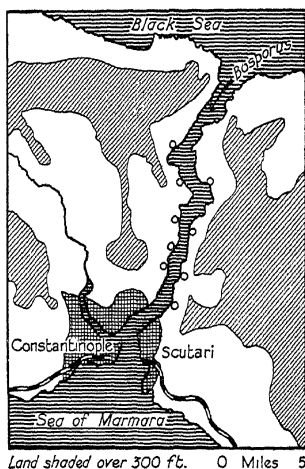


FIG. 56. CONSTANTINOPLE AND THE BOSPORUS (the circles indicate smaller places on the shores).

belong to the Mediterranean region. The conditions are not the same all over the country : the Balkan Range protects the country south of it from cold winds from the north-east, so that in this part the winters are considerably warmer than farther north ; and in the south of this plain the vegetation is almost Mediterranean in character.

The valleys down the northern slopes of the Balkans give access to the Danube, and there are several river ports, Ruschuk being the chief. Two railway routes cross the Balkan Range, connecting the Constantinople line with the Danube : the route from Sofia uses the Isker valley and that from Philippopolis crosses to Ruschuk by

the Shipka pass. The Black Sea ports of Varna and Burgas are served by the railway system.

The forests of Bulgaria are of considerable value. The pastoral industry is important. The plateau region of the north produces large crops of wheat and maize, most of the former being exported, and the latter kept for home use. South of the Balkan Range cereals are grown but there is also agriculture of a different type. The hot summers enable rice and cotton to be grown and silk to be produced, while tobacco is a crop in the south of the region. An important industry is that of rose-growing, chiefly in the Tunja valley (a tributary of the Maritsa), where there are thousands of acres of rose gardens. Attar (essence) of roses is manufactured from the rose-petals. The chief exports are wheat and maize, especially the former ; others are live-stock, attar of roses, wool, oats, rye, and silk cocoons.

*Turkey in Europe* consists of eastern Thrace (that is the part lying east of the Maritsa river), including the cities of Adrianople and Constantinople. The Maritsa valley, with the poor port of Dede Agach, to the west of it, forms a natural outlet to the Aegean Sea from Bulgaria. Farther east the high peninsula of Gallipoli and a hilly district between the Aegean and Black Seas, border the small Sea of Marmara and the straits which give access to it—the Dardanelles from the Aegean, the Bosphorus from the Black Sea. These three together, we have seen, form one of the great gateways to the Mediterranean. Here on the European shore of the Bosphorus where it enters Marmara, is Constantinople, till recent years the Turkish capital, not only the guardian of the Mediterranean-Black Sea gateway, but also the terminus of the Orient railway route from Europe, and the ferry-point across the Bosphorus between Europe and Asia.

## EXERCISES

1. From tables showing mean monthly temperatures, draw graphs showing annual temperatures of Valencia, London, Warsaw, &c. ; and from similar tables draw graphs to show annual rainfall of these places. Draw graphs for other towns situated at the same and at different latitudes and compare the results.<sup>1</sup>

<sup>1</sup> For the use of those who have opportunity to pursue this subject, tables are provided in Part II, Chap. XV.

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2. Describe two different types of climate experienced in Europe, state where each is experienced, and account for the differences as fully as you can.

3. What are the main causes and characteristics of a 'Mediterranean' climate, and how does it affect vegetation?

4. Contrast the climatic conditions prevailing in the centre of Ireland with those in the centre of Spain. Account for the contrast, and indicate any notable economic or other consequences of these conditions in each of the areas.

5. Europe includes regions which have (a) rain at all seasons; (b) rain mainly in the summer; (c) rain mainly in the winter. Name one district of Europe belonging to each group, and in each case give the reasons for the facts as fully as you can.

6. How far has land relief in (a) the western; (b) the central areas of the continent of Europe affected the arrangement of political divisions? Give examples in support of your statement.

7. Draw a sketch-map of the Balkan Peninsula, inserting boundaries and names of states, the rivers Danube, Maritsa, Morava, and Vardar, and the towns Adrianople, Belgrade, Nish, Salonika, and Sofia.

8. Into what natural regions would you divide Russia in Europe? State the most important characteristics of each region.

9. Describe the chief routes making use of the passes across the Alps, between Italy and the valleys of the Rhone, the Aar, and the Danube; illustrate your answer by a sketch-map.

10. Compare the coasts of the Adriatic with the European coast of the Black Sea in respect of (a) physical characteristics; (b) suitability for ports; (c) access to hinterland.

11. What is irrigation? Name any parts of the continent where you would expect it to be practised to a large extent, and point out the physical conditions which make irrigation necessary.

12. What are the natural resources of Switzerland? Show how the Swiss have endeavoured to take advantage of these resources. Discuss any advantages or disadvantages that the country possesses for trade.

13. Suggest a division of Central Europe (from Scandinavia to Italy), according to natural vegetation, and give reasons for your decision.

14. Write a description of the Hungarian plain, giving particular attention to (a) physical features; (b) climate, and (c) agriculture.

15. What important industries are carried on in the Rhine basin, and in what parts of it? Mention the important towns connected with each industry.

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16. Describe the physical features of the country traversed by the railway route (a) from Paris to Vienna *via* Strasbourg ; (b) from Vienna to Constantinople.

17. How do you account for the comparatively dense populations in (a) the Rhine basin below Cologne ; (b) the plain of the Po, and for the comparative scarcity of inhabitants in (c) Norway ; (d) south-east Russia ?

18. Describe accurately the situation of the coal-fields of northern France, Belgium, Germany, and Poland, showing how they lie with reference to the belt of uplands through central Europe.

19. Describe the sites of the following towns with reference to the great routes which converge upon them : Paris, Constantinople, Vienna, Marseilles, Hamburg, Warsaw.

20. Give an account of the distribution of the following industries over Europe : beet-sugar, cotton manufacture, silk manufacture, and vine cultivation.

21. Give the conditions under which the following are grown : wheat, maize, potatoes. Name areas which produce them in large quantities.

22. Name three large rivers of Europe which have been internationalized. What does this mean ? Give an account of the trade passing up and down these rivers.

23. Compare Belgium and Czecho-Slovakia with special reference to (a) physical features ; (b) natural resources ; (c) industries.

24. Locate and describe any industries in Europe which use water-power in place of coal. In each case say how the power is obtained.

25. Describe the physical features of (a) the coastline of Holland ; (b) the west coast of France ; (c) the coastline of Norway. Give sketch maps or diagrams. Consider the development of ports and the hinterland in each case.

## VI. ASIA

ASIA is the largest continent and covers about one-third of the land surface of the earth. Its area is over 16 million square miles, and it is nearly  $4\frac{1}{2}$  times the size of Europe. Its most westerly part borders the Mediterranean Sea in the peninsula of Asia Minor and in Syria. Its easternmost part is separated from North America only by the narrow Bering Strait in the far north-east. Between these most eastern and most western coasts there is a distance of  $165^{\circ}$  longitude. The northernmost point of the continent is little more than  $12^{\circ}$  from the North Pole; the southernmost, in the Malay Peninsula, only  $1^{\circ}$  north of the Equator. The division of Eurasia into two continents, Europe and Asia, and the boundary between them, have been considered on p. 76.

*Outline and Seas.*—The south-west coasts of the continent are washed by the Black Sea and Mediterranean Sea and their branches, the high peninsula of Asia Minor separating these two seas. From the northern corner of the Mediterranean in Syria there is a land-way, of no great height compared with the neighbouring mountains, eastward into the lowland which forms the valleys of the Euphrates and Tigris rivers—which is familiar to us under the name of Mesopotamia, and extends to the Persian Gulf, into which the two rivers flow in a united stream. This lowland and the gulf mark off the country of Syria, including Palestine, along the eastern Mediterranean coast (also called the Levant from its eastern position toward the rising sun), together with the plateau peninsula of Arabia, which is bounded on the west by the Red Sea and on the south by the Gulf of Aden and the Arabian Sea. Next, between the Arabian Sea and the Bay of Bengal, both divisions of the Indian Ocean, there rises the triangular peninsula of India; while east of the Bay of Bengal the narrow Malay Peninsula extends still farther south. The Malay Peninsula projects from the Indo-Chinese Peninsula, which is much wider, and includes the countries of Burma, Siam, and Indo-China. On the east coast there are two peninsulas of less importance, those of Korea and Kamchatka. Many large islands rise off this coast, from the Malay Peninsula, which is only separated by narrow straits from Sumatra and other great islands of the Malay

Archipelago, northward through Borneo, the Philippine Islands and Formosa, to the islands of Japan. Within these islands are enclosed a series of divisions of the Pacific Ocean, which borders Asia on the east ; the South China Sea and others within the Malay and Philippine Islands, the East China Sea and the Yellow Sea between Japan, Korea, and the mainland, the Sea of Japan farther north, and the sea of Okhotsk, marked off by the peninsula of Kamchatka. The

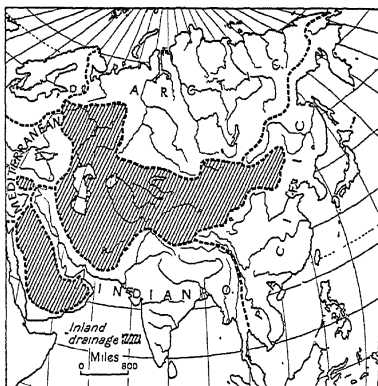


FIG. 57. OCEANIC DRAINAGE AREAS OF ASIA.

northern coast, washed by the ice-bound Arctic Ocean, is also irregular, with many islands off it and many long inlets.

*Highlands.*—The shape of Asia and its extent are such that an ordinary map of the whole continent must generally include most of Europe ; and a physical map shows that not only the northern European lowlands are continued eastward across Asia, but also the south European highlands. The line of the Caucasus Mountains, though stopped on the west coast of the Caspian Sea, is carried on beyond its east coast about the fortieth parallel of latitude by a mountain chain of which the principal part is known as Tien Shan. The highlands on the north side of Asia Minor are carried on around the south of the Caspian Sea and eastward until in Central Asia a great mountain system named Kunlun is seen. South of this line another line may be traced from the Taurus Mountains in the



south of Asia Minor, through the mountains eastward of Mesopotamia and the Persian Gulf, and extending thence to the north-west border of the peninsula of India, and thence eastward across the north of that peninsula in the mightiest system of mountains in the world, the Himalaya. The mountain systems in the west enclose the high plateau of Asia Minor, and farther to the east that of Iran in the countries of Persia and Afghanistan. Farther east again the highlands of Central Asia are narrowest in the region known as the Pamirs, a region of high narrow valleys and still higher narrow ridges, known sometimes as 'the roof of the world'. From here north-eastward the Tien Shan and other mountain chains form a series of uplands right across the continent to the north-east. From the Pamirs, again, the Kunlun mountains extend eastward, and between them and the north-east systems there are great tracts of desert in the territories known as Eastern Turkistan and Mongolia. In Turkistan a river, the Tarim, receives plenty of water from the surrounding mountains and flows far through the desert until it dries up in the swamps of Lop Nor. Even the bottom of this basin is nearly 3,000 ft. above sea-level, although to the north of it, and within this high-lying area, there is another similar basin that falls to great depths, even below sea-level. Eastward in Mongolia there is a still greater extent of desert known as the Gobi (a name meaning desert). The Kunlun mountains on the north and the Himalaya on the south enclose Tibet, the highest country in the world, 1,000,000 sq. miles of it where even the valleys lie from 12,000 to 16,000 ft. above sea-level, the plateaus still higher, and the summits of the mountain ranges from 20,000 to 25,000 ft. Mount Everest, the highest mountain in the world, in the Himalaya system, reaches just over 29,000 ft.

The mountain systems so far described are the result of tremendous folding in the earth's crust, and are young in comparison with the lower, longer denuded, highlands farther east. The newer folds are bent against the older highlands, and from the east of Tibet the folds run southward toward the Malay Peninsula. In Burma, Siam, and Indo-China they are separated by deep valleys carrying such big rivers as the Irrawadi and the Mekong to the Bay of Bengal and the South China Sea. The highlands extend to the coast at intervals all along the shores of the South China Sea and again in

the peninsula of Korea and farther north ; but the shores of the East China and Yellow seas are mostly low where they are bordered by the wide plains of China. The islands off the eastern coasts, Japan and the rest, are almost all mountainous (see Fig. 27).

*Lowlands.*—The highlands of Central Asia give place in the north to lowlands of vast extent which, as we have seen, continue eastward of the north European plains, to which may be added the Russian steppes north of the Black Sea. We found that the Caspian Sea has no outlet, and its surface and some of the land round it, especially on the north about the estuary of the river Volga, is below sea-level. To the east of it the Aral Sea is similar though smaller. The Aral Sea receives from the mountains to the south-east the rivers Oxus and Sir Darya, which water well the country immediately along their banks, as the Nile does Egypt ; but otherwise much of this country east of the Caspian is desert or nearly so, and it is drying quickly. So also is Eastern Turkistan. This process of drying, or desiccation, can be traced from descriptions by early travellers which show that they saw well watered and cultivated lands where now there is dry sandy waste ; and it can actually be seen, from the marks of higher shore-lines and other signs, how greatly the Aral Sea and other similar salt lakes in this region have shrunk.

The parallel of  $50^{\circ}$  N. roughly marks the divide between the streams which flow to the areas of inland drainage and those which flow northward to the Arctic Ocean. The northern lowlands are crossed by many rivers, mostly tributary to the three great ones, the Ob, the Yenisei, and the Lena. Of these the Yenisei marks the boundary of the lowlands to the west of it, which are very flat, liable to flooding by the rivers when the snows of winter melt and the ice breaks, and in some parts marshy. To the east of the Yenisei the lowland lies generally a little higher and is more undulating, and to the east of the Lena the northern part of the continent contains not only lowland but mountains, an extension of the east-central highlands, though of heights not to be compared with those of the mountains of Central Asia.

*The Southern Plateaus.*—The south-west part of the continent, marked off as it is by the Black, Mediterranean, Red, and Caspian Seas and the Persian Gulf, is sometimes called rather fancifully the Land of the Five Seas : it is not a physical unit, and for the most

part the seas have no great effect upon it, for reasons which will appear. We have seen that its southern part, Arabia, consists of a plateau, and this for the most part slopes eastward from greatest heights which border the Red Sea. Similarly the southern part of the peninsula of India consists of a plateau, known as the Deccan, which slopes eastward from greatest heights bordering the Arabian Sea. The Deccan is separated from the central mountains by a lowland extending right across the base of the peninsula and formed in the west by the lower basin of the river Indus and in the east by that of the river Ganges. Both these rivers have their sources in the central mountains, and the river Brahmaputra which enters the delta of the Ganges has a remarkable course, rising on the northern slopes of the Himalayas and flowing eastward to the north of them before it breaks through them and turns sharply west and south toward the Ganges. The course of the Indus may be compared : it is considered in Part II, p. 451.

*Relief Divisions.*—We have, then, a broad division of the continent of Asia according to relief into (1) a central region of high plateaus and mountains extending from south-west to north-east and south-east ; (2) lowlands to the north of this highland division ; (3) lowlands in the east, enclosed by the north-east and south-east extensions of the central highlands ; (4) the Deccan plateau in India, separated from the central highlands by the lowland of the Ganges and Indus basins.

*Climate.*—The great extent of Asia from north to south obviously suggests that we shall find every type of climate from arctic to equatorial. The great size of the continent suggests that a large area in the interior is far from the equable influence of the oceans, and that the climate is therefore extreme. These extreme conditions, ranging from intense heat in summer to frightful cold in winter, are increased in the centre (so far as concerns the winter cold) by the great height of the land. They are also increased because to the west of Asia lies Europe, and to the south-west, Africa ; and both help to keep off the influence of the oceans on that side. It is true that the Mediterranean Sea borders part of western Asia, but the coasts are generally high and the influence of the sea is not strongly marked for a great distance inland. The ocean influence of the Indian and Pacific Oceans extends over a large part of the south

and east, but would extend much farther if it were not for the central highlands. These, then, help to define a very remarkable climatic boundary between southern and eastern Asia—including India, the south-eastern peninsulas, China, and Japan—on the one hand, and the rest of the continent on the other. The east and south come, as we shall see presently, under the influence of monsoon types of climate, and have plenty of rain. Of the rest of the continent there probably is not more than about one-tenth where the rainfall, on an average, approaches even half that of the driest part of the monsoon region.

In winter a relatively high pressure of cold heavy air covers much of the interior and north of the continent. A map of mean pressure in January shows an anticyclone with its centre over east-central Asia and extending over the greater part of the continent; but in this connexion the method of reducing pressure to what it would be at sea-level has to be remembered, because actually the pressure over the high centre of the continent would be very different from that over the surrounding lowlands. A map of mean temperature in winter shows a centre of extreme cold over the north-eastern lowlands, where at a place called Verkhoyansk<sup>1</sup> there have been observations of the lowest temperature known in the world. The mean temperature in January is nearly  $-60^{\circ}$  F., and temperatures of  $-90^{\circ}$  F. have been recorded—over  $120^{\circ}$  of frost. The range of mean monthly temperature between July and January is nearly  $120^{\circ}$ . The winter cold, however, is usually accompanied by a calm air, so that it is not so severely felt as it might be; but there are sometimes fierce snowstorms which may overwhelm people exposed to them. The north-eastern position of this cold centre may be noted because it suggests that such oceanic influence as reaches the northern lowlands comes from the west across the great north Eurasian plain. Except in the extreme north the summers are warm or even hot, and the same conditions apply over almost the whole of the central highlands, the range of temperature between summer and winter being very great.

The high ranges of the Himalayas keep off the winter cold from India to a great extent, but the edge of the highlands is lower and less unbroken toward the east, and unusually cool temperatures in

<sup>1</sup> See Table in Part II, p. 486.

winter are found far to the south. The south coast of China has probably the lowest winter temperature near sea-level for its latitude, and the mean January isotherm of  $32^{\circ}$  F. crosses the east coast of Asia about  $35^{\circ}$  N. lat., which is about  $5^{\circ}$  farther south than on the east coast of North America. (See Fig. 28.)

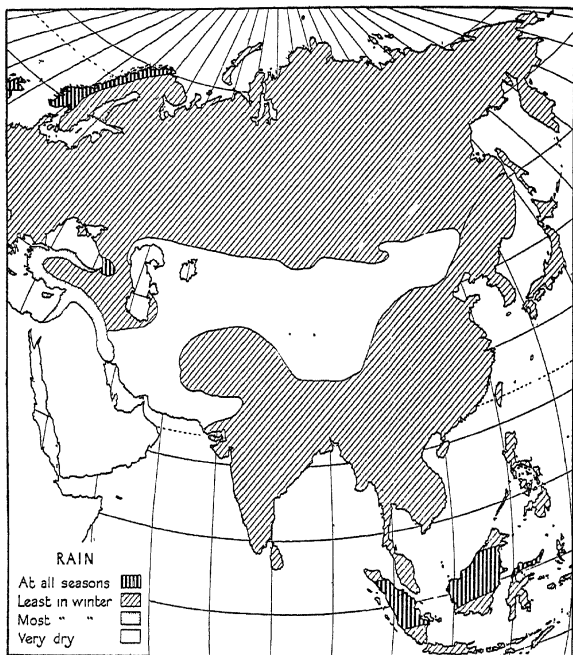
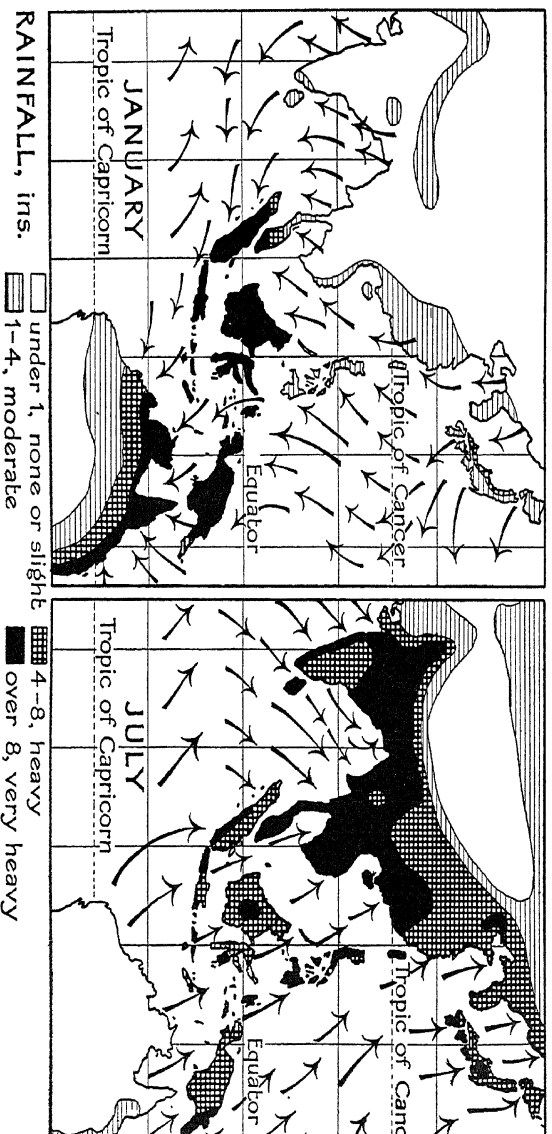


FIG. 58. SEASONAL RAINFALL IN ASIA.

The absence of rain-bearing winds accounts for the dryness of the highlands and for the great extent of desert from Arabia as far as the desert of the Gobi in the east. The northern lowlands also have no large amount of rain; but it mostly falls in summer and is sufficient, as we shall see, for agriculture.

*The Monsoons.*—In summer the conditions of pressure over the continent are completely changed. The air is hot and the pressure



Figs. 59, 60. Mean rainfall and prevalent winds for January and July, in the monsoon regions of Asia and Northern Australia, with the intervening equatorial belt where the rainfall is always heavy.

low, particularly so over the area to the north of the Arabian Sea. A strong movement of the air toward the land from the belt of high pressure over the ocean to the south and south-east is now set up, and rain-bearing winds blow strongly and cause the summer to be the rainy season. These summer rains are known generally as the monsoon<sup>1</sup> rains, the word 'monsoon', perhaps derived from an Arabic word meaning 'season', indicating the tremendous and sudden change between the weather conditions of this season and the rest of the year. The monsoon region as a whole has to be divided, as we shall find when we come to details about India and China, into several divisions in which the conditions of climate somewhat differ, but broadly speaking it may be said that the monsoon rains fall from May or June to September. In India from September to December, as pressure conditions gradually change, the monsoon retreats southward. January to February is a cool season and generally dry, though not rainless in all parts of the monsoon region. From March to June there is a dry period with great heat. The rainy monsoon reaches western India from the south-west across the Arabian Sea and from the south and south-east across the Bay of Bengal. The winds are drawn around and toward the low-pressure centre north of the Arabian Sea and the current from the Bay of Bengal passes westward over the plain of the Ganges, guided by the wall of the Himalayas to the north. During this passage over the land the winds lose their moisture, and by the time they reach the north-west of India they are dry. Moreover, the winds from the west bring no rain to the north-west as they also have crossed no wide extent of sea. In the north-west of India there is a low-lying region, dry though at no great distance from the sea, of which part is actually a desert, that of Thar.

The extreme south of the continent and the Malay Archipelago have an equatorial climate, hot, with hardly any range of temperature, and a heavy rainfall which varies considerably according to the elevation of the highlands and exposure to sea winds or shelter from them.

*Vegetation.*—In south-western Asia, as we have seen, Mediterranean conditions of climate with hot dry summers and warm wet winters are found along a coastal strip bordering the west and south

<sup>1</sup> See further Part II, p. 478.

of Asia Minor and the Levant. Similar conditions are found along the eastern part of the north coast of Asia Minor, bordering the Black Sea. The typical Mediterranean vegetation is seen, with the olive, cypress, and other evergreens. Arabia is almost wholly desert,

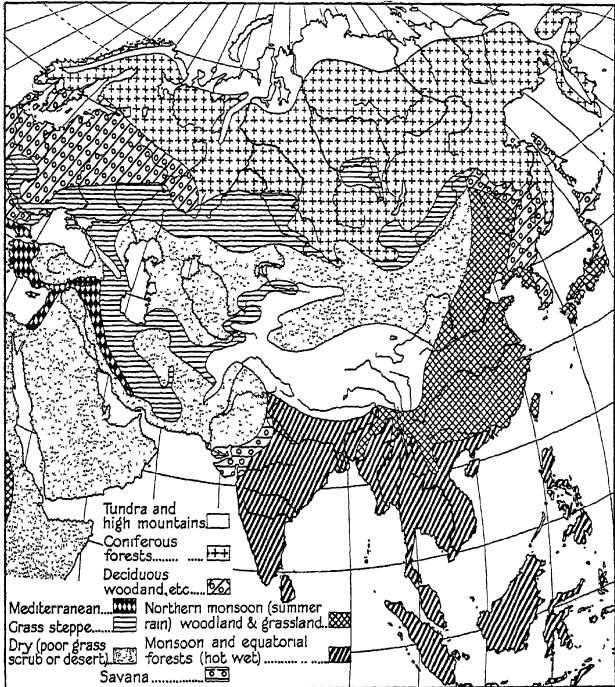


FIG. 61. NATURAL VEGETATION OF ASIA.

although the south-west comes to a small extent under monsoon influence. In Persia and western Turkistan there is much poor grass-land, and cultivation is possible only along the rivers and in mountain valleys along the flank of the central highlands, on the south shores of the Caspian Sea where northerly winds bring a fair rainfall, and in other favoured localities. In Mesopotamia the date palm is found in great numbers near the rivers and elsewhere



throughout the region in oases. Palms are typical of oases in tropical deserts, but their place is taken, in the oases of central Asia in more northerly latitudes, by poplars and other trees common in temperate lands. The deserts of Turkistan pass northward into poor grass and sage-bush steppe, which becomes richer farther north, until, approximately along the latitude of  $55^{\circ}$  N., there is a zone of prairie grass-land which may be compared with that of North America, and is valuable for agriculture except in some parts of western Siberia where the land is low-lying, flat, poorly drained by the rivers, and marshy. To the north of this grass-land is found the wide belt of the northern coniferous forest which is seen also in Europe and North America. In eastern Siberia it covers practically the whole of the country between the central highlands and the Arctic belt of tundra which fringes the shores of the Arctic Ocean. On the north-east coast the conifers give place gradually farther south to deciduous trees, as in eastern North America. In China the natural forest vegetation has been very largely cleared for agriculture, for China contains lands which are among the most closely cultivated in the world. In Japan a particularly good example is seen of the successive zones of vegetation at different elevations, as the islands are generally mountainous. The forests vary from deciduous trees, with cedar and cypress, to conifers of the northern type at greater elevations, with alpine pastures at the highest elevation below the snow line. The south-east of Asia and much of the Malay Archipelago are covered, where not cleared for agriculture, with dense equatorial forests in the wettest parts but more open woodland where rainfall is less heavy. The northern plain of India shows a transition from tropical jungles in the east, through rich agricultural land, to desert in the west. On the plateau of the Deccan, on the other hand, the heavy forests are found in the west and lighter woodlands or jungles of scrub or grass-land, according to the drier conditions, farther east. This accords with the varying conditions of the monsoon rainfall according to locality, as we shall find later.

*Animals.*—The animal life of so vast a continent must, of course, be greatly varied. We may notice the importance of fur-bearing animals in the far north, the breeding of sheep and horses on the higher steppes, the use of the camel as a beast of burden in the deserts, though at the same time we may recall the fame of Arabia and Persia

for their horses. In the high territory of Tibet we find the peculiar yak, a kind of mountain ox, and in India and other hot countries the humped oxen and buffalo are also used as draught animals. Among the many wild animals in India the elephant has a peculiar importance as being capable of becoming tame and being put to work.

The division between Asiatic and Australian types of animals, and, to some extent, of vegetation, is of interest. A line, called Wallace's line from the famous naturalist Alfred Russel Wallace, who drew it, is taken between the small islands of Bali and Lombok in the Malay Archipelago and carried thence between Borneo and Celebes and south of the Philippine Islands. The seas along this line are deep, but to the west, around the islands nearest to Asia, they are shallow. In these western islands the animal life and vegetation are related to those of south-eastern Asia; to the east of the line there is a transition between Asiatic and Australian forms. The line must not be too strictly drawn, and some authorities would place it farther east. At any rate, the shallow seas extending south-eastward from Asia suggest that the more westerly islands of the archipelago were joined to the continent at an earlier geological age, when Asiatic forms of life were able to penetrate.

*Natural Regions.*—We may now divide Asia into the following natural regions :

1. The borders of the Mediterranean Sea and the eastern part of the Black Sea ;

2. The plateaus of Asia Minor and Iran, with the lowland of Mesopotamia ;

3. The lowlands of Turan. Regions (2) and (3) are classed as temperate and not hot regions, and considering their latitude this is justified, but the great range of temperature between very hot summers and cold winters must be remembered.

4. The hot desert of Arabia, and that of Thar in north-western India ;

5. The central plateaus of Eastern Turkistan and Mongolia and the higher plateau of Tibet, all with exceedingly cold winters but the two first hot and dry in summer and largely desert ;

6. The north-central highlands with temperate conditions ;

7. The northern lowlands of Siberia with temperate to cold conditions ;

8. The tundra of the Arctic zone ;

9. The monsoon region, which may be divided into (a) the north-eastern division including Amuria and Manchuria, with some of northern China ; (b) the central division, including the greater part of China, and (c) the southern division, including south-eastern Asia and India.

10. The equatorial region of the extreme south of the mainland and the Malay Archipelago.

*Population.*—The most notable feature in the general distribution of people over Asia is the distinction which must be drawn between monsoon lands and the rest. If we compare two maps showing the lowlands of the monsoon region and the limits of territories in which there are generally more than twenty-five people to the square mile on an average, it will be seen that the boundary lines very closely agree. The explanation is clear. The monsoon region has climatic conditions favourable for agriculture, and over large parts of the region the relief and soil are equally well suited ; so that over large areas population is far more than twenty-five to the square mile. Indeed, parts of China and India are among the most densely inhabited agricultural lands in the world, each square mile supporting many hundreds. Outside the monsoon region the most dense population on an average is found in the Mediterranean region and here again the reason is clear. The climatic conditions are favourable ; and, it may be added, the area is comparatively small, and there is a tendency for the population to concentrate in it.

Of the three great divisions of mankind, the white, the yellow, and the black, the yellow are most numerous in Asia. They include in the east the Japanese and the Chinese, in the north and west the native tribes of Siberia and the steppe region. Some of these northern tribes spread over Arctic Europe and include the Lapps and Finns in the north-west of Europe. Others of the same great division have penetrated the south-west of Asia and parts of Europe at various historical times. Examples are a few of the tribes in Asia Minor, and, again, the Magyars in central Europe, especially Hungary. Another important people belonging to this division are the Malays in the south-east of Asia and the Archipelago. Every stage of civilization is represented among the yellow peoples of Asia. The Japanese have their own civilization but have shared in

the development of education, science, and industry which are found in Europe and have been carried thence to North America. The Chinese to some extent have done the same. Their own peculiar civilization, however, is very old, and their nature and traditions have not allowed them to welcome European civilization to the same extent as the Japanese. At the other end of the scale are the peoples

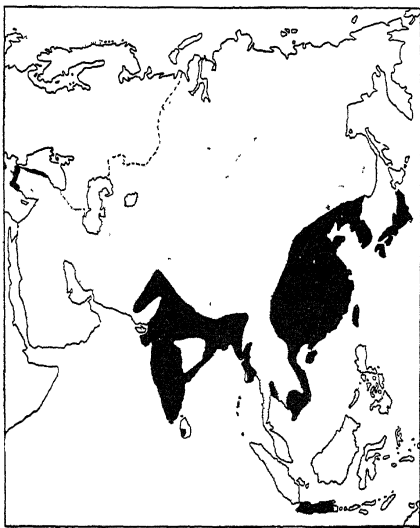


FIG. 62. The parts of Asia where the population is densest (shown in black) and scantiest (white). The close relation between density of population and the conditions of (i) the monsoon region, (ii) the Mediterranean fringe, is seen. (The adjacent parts of Europe may be filled in from Fig. 34.)

of Central Asia, few in numbers, of no political strength, and limited by the geographical conditions under which they live to simple nomadic life of no little hardship. Nomadic also are the people of the dry steppe country south-west of Siberia, dependent on their flocks for almost everything in life and wandering here and there as sufficient pasture can be found and is used up. Among the inhabitants broadly classed as white we have the population of the south-west of the continent generally, including most of the Turks, the Arabs, the Persians and others, and the majority of the inhabi-

tants of India ; also in the north, along the line of the grasslands most fit for cultivation in Siberia, there is a line of penetration by immigrants coming from Europe. The black division of mankind is found mostly, so far as Asia is concerned, in the Malay Peninsula, Sumatra, the Andamans, and other islands to the south-east.

*Political Division.*—The peninsula of Asia Minor includes the greater part of the Turkish Republic, which extends across the Bosphorus into Europe and includes a small territory surrounding the city of Constantinople. The country between the peninsula of Asia Minor and the Caspian Sea, and south of the Caucasus Mountains, has long been inhabited by peoples of various stocks, divided, on account of the mountainous relief of the land, with its difficult communications, into little nationalities and clans, frequently hostile one to another. Here is the territory of Armenia, long oppressed by the Turks ; here also are certain small republics belonging to the Russian Union of Soviet Republics. These lie immediately south of the Caucasus Mountains, across which Russia, when still an empire, had penetrated. Armenia lies south of these, and south again is Kurdistan, a wild land from which wild mountain people have many times raided the lowland of Mesopotamia. This name means strictly ‘ the land in the midst of the rivers ’, that is to say, the Tigris and Euphrates ; but it became extended over the whole lowland basin which drains to the head of the Persian Gulf. A name more commonly used now is that of Iraq, an Arab State not long established and protected under mandate by Britain. Syria, the territory bordering the eastern or Levantine coast of the Mediterranean Sea, is divided between the administration of France in the north and Britain in the south, so that the Holy Land of Palestine falls under British control. The peninsula of Arabia, largely desert, and containing at the best only scattered tracts fit for habitation, mainly by nomads, is divided under various Arabian rulers. In the south-west there is British territory surrounding Aden.

The territory of Persia comprises most of the plateau of Iran, and borders the Persian Gulf on its north side and extends to the southern shore of the Caspian Sea. To the east of it, but not reaching any sea, the mountainous territory of Afghanistan borders the north-west of the empire of India. India is an Empire within the

British Empire, and the British colony of Ceylon lies off its southern extremity. India is partly bordered on the north by small native states, isolated and remote among the Himalaya Mountains. The lowlands between the Caspian Sea and the central highlands, including western Turkistan, the whole of Siberia, and eastward to the Pacific shores from Bering Strait to the base of the peninsula of Korea, are Russian territory. The central highlands north of the Himalaya and practically the whole country south of the Russian territory as far as the base of the south-eastern peninsula—that is, approximately between  $20^{\circ}$  N. lat. and the Tropic of Cancer, belonged to the Chinese Republic ; but this republic, being itself without any strong central government, has lost authority over such remote territories as Tibet and Mongolia. Japan is mainly an island empire, possessing the islands from  $50^{\circ}$  N. southward to Formosa on the tropic ; but the peninsula of Korea is also included in the empire. The eastern part of the Indo-Chinese peninsula is called French Indo-China ; and besides this France possesses also certain small tracts in India. The west of the Indo-Chinese peninsula belongs mainly to the native State of Siam ; but the south of the Malay Peninsula is British. Here and in the island of Borneo and certain other islands are the territories which make up the Straits Settlements of the British Empire. These settlements began on and about the coasts and strait of Malacca, between the peninsula and the island of Sumatra. The greater part of the Malay Archipelago, excepting a small bit of Portuguese territory, belongs to Holland and is called politically Netherlands India, sometimes also the Dutch East Indies, the East Indies being an alternative name for the archipelago as a whole. The Philippine Islands, the northward part of the archipelago, belong to the United States of America.

*The British Empire in Asia.*—Apart from India, an empire, as we have seen, in itself, British territories in Asia are especially notable in a geographical sense for the extreme importance of their positions in relation to communications and trade. Great Britain has a controlling interest in the Suez Canal, leading from the Mediterranean to the northern end of the Red Sea. At its southern end of that sea is Aden, held as a port of call for shipping on the main routes to India. The control of Mesopotamia has a somewhat similar importance politically ; for the Tigris-Euphrates lowland offers, as we shall see, part

of a land route from Europe to the Persian Gulf and so by sea again to India. All shipping to the east of India and to the Far East, as the countries of eastern Asia are usually called, must pass around the island of Ceylon and through the Straits of Malacca, in order to round the Malay Peninsula. On each of these, we shall find, there are great ports in British possession. Again, off the southern coast of China there is the small British island of Hong-Kong which has become one of the greatest seaports in the world. Farther north, commanding the Yellow Sea and its inlets, there is the small British territory of Wei-Hai-Wei, held as a naval base for the protection of British trading interests in northern China.

*Occupations : Agricultural Products.*—In regard to occupations Asia supplies examples of every form of what may be called the primitive occupations, from the hunting in the northern forests to the intensive agriculture on the closely inhabited lands in the south and south-east, and to the collection of natural products of the equatorial forests. We shall look for examples of these occupations, controlled by geographical conditions of climate, vegetation, and relief. Nomadic habits of life are fully developed in Asia, as for example among the hunters of the north, the dwellers in the steppes and in the deserts. And in some parts there are half-nomads, pastoral peoples who feed their animals on the grass of the lowlands in the winter and spring, and move in summer, when these pastures are dried up, to the upland grass which at that season is fresh but in winter may be covered with snow. Such movement between the seasons is found, for example, in Asia Minor and on the northern borders of the central highlands. In agriculture there is a remarkable contrast between the wheat lands and the rice lands. Wheat is cultivated in Siberia and exported, as it is from North America, though not in such great quantity. It is grown also in north-western India as a winter crop and exported largely. Both lands help to provide food supplies of more densely inhabited countries elsewhere. Rice is a large export from the monsoon region of Asia ; but the proportion exported is very small compared with the total amount grown, which is eaten by the very large population on the spot. The most densely populated lands in the monsoon region are very nearly the same as the richest rice-lands, which are low-lying, as along the plain tracks of rivers or in their deltas, alluvial lands subject to flood

from rains, or lands capable of being irrigated. Such lands are found chiefly in the plain of the Ganges and along the western and eastern coasts of the Deccan in India, in the alluvial lowlands of south-eastern Asia and the eastern plain of China, in Java, and in Japan. Millet is another widespread crop in India. Other products which we shall find entering into the commerce of Asiatic lands as exports are mostly vegetable products, such as cotton, jute, tea, and rubber, the distribution of which must be observed when we come to details about the monsoon and equatorial lands. Some parts of Asia—China in particular—are known to be richer in minerals than the present output suggests. The most important mineral production in Asiatic commerce is that of tin from the Malay Peninsula and certain of the Malay islands. There are not in Asia great manufacturing districts to be compared with those of Europe and North America. Some manufacture has been developed on modern lines in Japan and in India, but the manufacturing population in Asiatic lands generally is very small in proportion to the total.

*Communications.*—The principal sea routes between Europe and Asia lead, as we have seen, through the Suez Canal from the Mediterranean and along the Red Sea, past British Aden. All routes except those to western India and the Persian Gulf must pass around Ceylon, and from the port of Colombo in that island routes diverge for eastern India, for the Far East, and for Australia respectively. Eastern and south-eastern Asia are connected with Australia by direct routes through the archipelago. Important routes cross the Pacific Ocean, connecting the Far East with the North American ports of Vancouver and San Francisco. It is obvious from the map that the making of the Suez Canal very much shortened the sea-routes between Europe and Asia in comparison with the route around the south of Africa. The need for shortening the route to the east was felt before the canal was made, when for fast traffic it was worth while to land from one ship in the Mediterranean, cross the Isthmus of Suez, and embark upon another ship in the Red Sea. Even now the sea route around Arabia to western India, and still more to the Persian Gulf, is indirect; and a railway route through Asia Minor and Iraq to the Persian Gulf has long been thought of though never quite completed. This is the line commonly spoken of as the



Baghdad Railway, starting, as we shall find later, from the shore of the Bosphorus and designed to connect with the head of the Persian Gulf. Since the British connexion with Iraq is made close by the possession of a mandate for the administration of this Arab kingdom, the long sea route around Arabia is a drawback which has led to the development of air services across the Syrian desert from Egypt, and also to services by motor-car from Damascus and other points in Syria ; for this desert, or poor steppe country, has in some parts a hard, fairly smooth, surface, not covered with the deep sands which we usually connect with hot deserts.

The principal lines of communication between Europe and central and northern Asia are provided by two railways from European Russia. The Trans-Caspian Railway serves the territory lying across the Caspian Sea from Europe, that is to say, Western Turkistan. The Trans-Siberian railway runs across Siberia, following the fertile and open prairie region as far as it can, and then in the east crossing more difficult country around Lake Baikal and thence to the east coast, where it connects with the port of Vladivostok. Also, as the country behind this port is not rich and the harbour itself may be ice-bound in winter, the railway has been carried southward to the Yellow Sea (see further, p. 220). Among the countries of Asia, India has the fullest system of railways, but no railway connexion with countries far outside its borders. In Japan railway communications are fairly developed for so mountainous a country ; in China the railway system is confined to the east and is not extensive there ; in south-eastern Asia the railway system connects the Malay Peninsula and Siam. In other parts of the continent there are few railways, if any. River navigation is important in China and to some extent in Siberia, as we shall see. In the dry regions trade is carried on largely by means of caravans of camels, donkeys, horses, or oxen ; and over the high passes of Central Asia yaks are used and even the sheep are made to carry small loads. Long caravan routes between China and Western Turkistan run principally along the north side of the central deserts through the oases at the foot of the northern mountains. Transport by animal caravans has been practised for many centuries ; but motor-cars are now used freely over the dry surface between northern China and Mongolia. On the other hand, the lowest scale of commercial

transport, that of the carriage of goods by men, is found, for example, in the difficult mountainous country of China and Tibet and of Japan.

### ASIA MINOR

*Physical Features.*—The peninsula of Asia Minor between the Black, Aegean, and eastern Mediterranean seas is usually taken to extend eastward to the upper valley of the Euphrates. This represents most of the territory of Turkey, which, however, extends beyond the Euphrates to the wild mountainous country of Armenia and Kurdistan. The name Anatolia is sometimes used instead of Asia Minor, but properly does not include the southern part of the peninsula. Asia Minor is a plateau rising from 3,000 to 5,000 ft. above sea-level, surrounded on the north, east, and south by a high rim of mountains. On the west there is also a mountain rim but this is lower and more broken. The northern mountain ranges are sometimes called the Pontic ranges, from Pontus, the classical name of the Black Sea. The southern ranges are those of the Taurus Mountains, which rise to an extreme height of 11,500 ft.; the eastern ranges are called anti-Taurus. Deep narrow valleys break through the ranges on the north, short valleys open to the south, there is little coastal lowland on either side, and communications are difficult. On the west, however, long rivers run through wider valleys from the high plateau to the Aegean Sea and communications are easier. One of these rivers, the Meander, has a course so winding that the verb 'to meander' is derived from it, and in geography a deep bend of any river is called a meander. The western part of the plateau consists of rolling country with wide valleys. The eastern is a level plain with cone-shaped mountains often of volcanic origin. There are no active volcanoes, but there are hot springs in many parts of the peninsula, and the west is liable to earthquakes, though less so than some other parts of the Mediterranean region. There is on the plateau a large area of inland drainage, mainly to the shallow salt lake called Tuzgöl. Under Mediterranean conditions of climate in the west and south, and a fair rainfall in the north, the coastal slopes and the western part of the plateau are generally fertile in the valleys, and the mountains are fairly wooded. The plateau is mostly without trees,

## Asia

but has good pasture-lands, especially in the north-west. In the centre and east it is dry in summer and the winters are very hard.

*Population.*—The ruling people are Turks and their government has been bad in many ways. Until recent times it extended in Asia not only over Asia Minor but into Syria, Mesopotamia, and Arabia, and all those lands were the homes of people of high civilization in early times and were better cultivated (where cultivation was possible) and more prosperous than they became under Turkish rule. The population of Asia Minor, as of neighbouring lands, is much mixed. People of the Christian and Mohammedan religions are intermingled and have often been in conflict.

*Products and Communications.*—Among the more important products are silk, mohair from the Angora goat, wool, and tobacco, and there is some manufacture of carpets, and other industries connected with the products mentioned. Mineral wealth is known to be large but it has not been much worked. Three of the natural routes from west to east through Asia Minor are followed by railways. The chief of these is the Anatolian Railway, starting from Haidar Pasha on the Bosphorus opposite Constantinople and thus continuing the Orient route across Europe. It reaches the plateau by way of the valley of the Sakaria, and it has a branch to Angora, the centre for the trade of the plateau and the seat of the Turkish government. Smyrna is marked out naturally as the chief western port, for it commands the valleys giving access from the Aegean coast to the plateau, and it has railways up the valleys of the Gediz and the Meander. The first of these joins the Anatolian Railway, which proceeds across the southern part of the plateau, and tunnels through the Taurus Mountains not far from a famous ancient road-pass known as the Cilician Gates. The railway descends to Adana, the chief town in the Cilician Plain, and has a branch to Alexandretta, the port on the gulf of the same name, which is the north-east corner of the eastern Mediterranean. The main line runs to the city of Aleppo, near which it joins the railway leading southward through Syria to western Arabia and to the Suez Canal, thus affording communication with Egypt. The line eastward into Iraq leading to Baghdad is not completed as we have seen, but in Iraq itself there is communication between Baghdad and the Persian Gulf.

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## SYRIA

*Physical Features.*—The relief of the land bordering the eastern Mediterranean Sea is arranged in three parallel belts running north and south. The western belt consists of a series of ranges of mountains or hills, with narrow coastal lowlands where the slopes do not reach the sea. The central belt is a deep depression; the eastern is a plateau broken in parts by mountains. The western mountain belt reaches its greatest height in Mount Lebanon, about 10,000 ft. The coastal lowland is widest south of Mount Carmel in the plains known of old as Philistia and Sharon. The coastal slopes facing towards the Mediterranean are naturally better watered than those sloping eastward, which also are shorter and steeper. The more fertile and longer valleys are therefore on the west. Toward the south much of the hill country is stony and has only scrubby vegetation, and it merges into the desert which extends southward to the Red Sea and Arabia. The central depression consists in the north of two valleys from which rivers break through westward to the Mediterranean. Farther south it is drained by the river Jordan which flows into the Dead Sea, 1,300 ft. below sea-level. This depression is considered to be a part of the rift valley which is continued southward along the Gulf of Akaba in the Red Sea and is traced farther in East Africa (p. 258). A rift valley, of which this is an example on a huge scale, is the name given to a depression formed when a strip of the earth's surface has been let down between parallel faults. A fault is a 'plane of dislocation' in the earth's crust, where a portion of the crust has slipped down, so that the various strata or rock-formations are not continuous.<sup>1</sup> The depression of the Jordan, sheltered and deep, is very hot in summer and has a rich, almost tropical, vegetation on the bottom lands where there is water. The eastern plateau consists in the north of high rolling downs, fertile though dry, extending to the river Euphrates. Farther south its surface is broken and often rugged, but it has many fertile tracts. The plain of Damascus extends from the plateau eastward as an oasis in the desert.

*Products, Population, and Communications.*—With the differences

<sup>1</sup> See further, Part II, p. 432.

## Asia

of relief there are also differences of temperature and rainfall and therefore of vegetation in different parts of this relatively small country. In the plains along the Mediterranean tree cultivation is important, including the fig, the olive, and other fruit trees, among which are mulberries, the leaves of which feed silkworms. The eastern belt yields chiefly wheat and barley. Bordering the desert there is often enough pasture for flocks, but these have to be moved

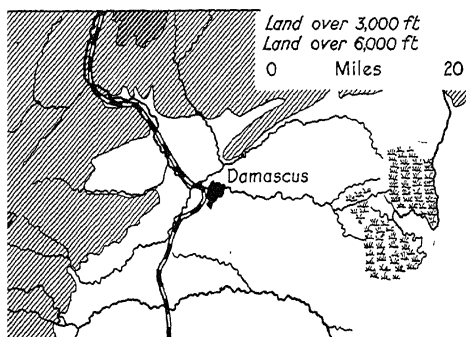


FIG. 63. THE POSITION OF DAMASCUS. Rivers flow eastward from the mountains to end in the marshes towards the interior desert.

as the pasture is used up, and the Bedouin Arabs are nomads and live in tents, in distinction from the Syrian peasants who cultivate land and live in villages. The depression of the Jordan divides Palestine to the west, and under British administration, from Arab territory to the east; while French Syria lies north of both. Many Jews have settled in Palestine in recent years, coming from various countries to the land which their forefathers occupied. Many Syrians migrate, especially to the Americas, where prosperous colonies of Syrians are found. The industries are connected mostly with agricultural products such as the making of olive oil and soap, the drying of grapes for raisins, and the manufacture of tobacco. The town of Aleppo, commanding the down country between the northern Mediterranean and the Euphrates, is an important old trade centre, now near the junction of the railway from Asia Minor with that southward to Palestine, Egypt, and Arabia. Damascus in its

broad oasis is another trading centre famous of old. Jerusalem, the capital of Palestine, is in a position which rather suggests defence against enemies. Of the ports, Alexandretta exports especially live stock, textiles, and silk ; Beirut, silk ; Jaffa, oranges, one sort of which is named from it ; Tripoli, wool, olive oil, and fruit ; and Haifa, grain. All these ports have railways branching from the main line inland, Jaffa being also the port for Jerusalem. There is some promise of the development of water power for generating electricity ; and the Jordan in its low valley, and unnavigable, could be

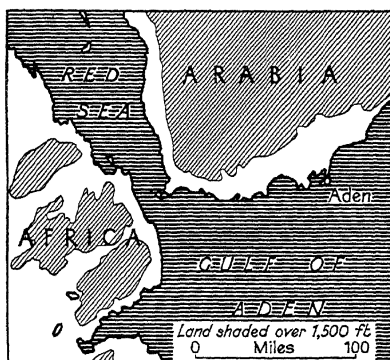


FIG. 64. THE POSITION OF ADEN.

of little use otherwise to man as its waters cannot be used for irrigation. The salts of the Dead Sea, however, may prove to be worth extracting from the water.

## ARABIA

The desert plateau of Arabia lies in great part 3,000 ft. or more above sea-level and in Yemen in the south-west there are mountains up to 10,000 ft. In this district there is some monsoon rainfall on the heights, but elsewhere there is little or none. There are, however, oases in the desert, notably Nejd in the centre. The habitable oases are separated by uninhabitable desert. Partly for this reason, the peninsula is divided politically between several

rulers, though all the inhabitants are Arabs. The country is noted for its horses and camels and the oases grow date-palms. The production of coffee for which Yemen was famous has declined, though the port of Mocha gives its name to a kind of coffee. The chief inland town is Mecca, the holy city of the Mohammedans, attracting thousands of pilgrims, who reach it by railway from Syria, as well as from its port Jiddah on the Red Sea. Aden in the south-west has a fine natural harbour. It forms, as we have seen, an outer gateway to India, and to India it is attached for administration. The harbour and its position have compelled the use of the place ; but the country is so dry and unproductive that almost all the necessities of life must be imported, and much of the fresh water is evaporated from sea-water.

### IRAQ

The northern part of Iraq is a low plateau broken occasionally by hills. The southern part is a level plain, and the deposits of the rivers Euphrates and Tigris, which join toward the Persian Gulf in the Shatt el-Arab, have extended the land far into the gulf within the history of man. The climate is sub-tropical and extreme, with slight rain in the winter as depressions pass from the Mediterranean. The land is fertile where irrigated, and in very early times it was the seat of famous civilizations with which the names of Nineveh and Babylon are associated. The Turkish government, under which the country had come until recent years, was weak ; the land lay open to raiders from the desert and from the mountains to the north-east, and its prosperity declined. Under Arab rule and British protection it should greatly improve again. The lower lands, especially on the west side of the Shatt el-Arab, form the principal centre of date cultivation. Various grains and liquorice are among other products, and petroleum is found. The port is Basra above the mouth of the Shatt el-Arab, and the rivers are navigable far inland, particularly the Tigris, on which is situated the city of Baghdad, in a position convenient for communication both over the lowlands and eastward through the mountains into Persia. The port of Koweit, at the north-western corner of the Persian Gulf, under British protection, has been considered as the terminus of a through route from the Mediterranean to the Persian Gulf such as has been

mentioned already under the name of the Baghdad Railway. Lines connect Baghdad with Basra, with Kalat Shergat up the Tigris towards Mosul, and north-eastward with the Persian frontier.

#### ARMENIA AND CAUCASIA

We have already found that the mountainous country north of Iraq and south of the Caucasus Mountains is divided into several small states, communications being difficult and the population tending to become isolated in groups of different peoples. The richest country is that immediately south of the Caucasus, where a succession of fertile valleys, mostly with good rainfall and well watered, extends between the Black and the Caspian seas. It is well forested, has good pasture land and grows grain, tobacco, cotton, and the vine. It is also rich in minerals. The chief mineral product is petroleum and the chief field for it is around the port of Baku on the Caspian Sea. This has railway connexion with Batum on the Black Sea and also connexion by pipe-line for the transport of the oil. The city of Tiflis lies on the railway, midway between the seas, and determined in position by its relation to the Daryal Pass across the Caucasus Mountains from the north. Near it is a junction for the railway southward into Armenia and north-western Persia. The highlands of Armenia, in which the famous Mount Ararat reaches nearly 17,000 ft., are difficult of access. The rivers flow mostly in deep gorges, and cultivation is possible only where the valleys widen, as round the town of Erzerum, a terminus of the railway and a station on the road across the mountains to the port of Trebizond on the Black Sea. This road rises to heights of nearly 8,000 ft., but it has long carried considerable trade between Persia and the Black Sea.

#### PERSIA

The plateau of Iran, which includes the greater part of Persia, lies at a general height of 4,000 to 5,000 ft. in the west, but in the east in the district of Seistan the general height is not more than 2,000 ft., and in some of the depressions it is much less. The east, and the depressions especially, are largely desert, the streams from the hills losing themselves in marshes or drying up in the sands. The whole plateau is bordered almost all round by mountains, of which



the highest are near the south of the Caspian Sea, and reach the extreme height of 18,600 ft. in Mount Elburz. The narrow coastal strip along the Caspian shores is below sea-level, and there is also no more than a narrow strip along the north shore of the Persian Gulf before the edge of the plateau rises steeply. The western part of the plateau is more habitable. There is a fair precipitation on much of the highest ground, heaviest in winter when it consists largely of snow. When this melts in the spring, and the streams are full and the lower lands can be irrigated from them, the country appears far more fertile than it does during the drought of summer, but the irrigated gardens are always notable by contrast with their arid surroundings. The government of the country has long been backward, and our description will have suggested that communications with other countries and within Persia itself are very difficult. There is a railway from Caucasia as far as Tabriz in the north-west, and there is one from India to the eastern frontier and one from Russian territory near the northern frontier; but within Persia there are few roads for wheeled traffic and trade must be carried largely by caravan. The river Karun is navigable from the Persian Gulf, and its port of Muhammara is good, much better than that of Bushire on the Gulf itself with its open roadstead and difficult country behind it. The capital is Teheran in the west-central part of the country, a centre for routes converging from Tabriz, the Caspian coast near Resht, the railway for Baghdad to the west, and the Persian Gulf in the south. The trade of the country is in such articles as silk and carpets and pearls from the Gulf, and there is an important output of petroleum in the south (Karun valley), with a pipe-line for its conveyance to the Gulf. This oil-field is of great importance to British trade.

#### RUSSIAN TURKISTAN

The most fertile and most populous part of west central Asia is comprised in the valleys of the mountainous border which open upon the great dry lowland. The lowland itself is fertile only as far as the rivers from the mountains can be used for irrigation. These, as we have seen, either enter inland lakes such as Balkash and the sea of Aral, or are lost in the sands of the desert. The

Kirghiz steppe in the north belongs to that region which we have already noticed (p. 201) as fit only for nomads. Along the rivers surrounded by irrigated oases is a series of towns famous in history, Merv on the Murghab river, Khiva on the Oxus, Bokhara and Samarkand on the Zarafshan, Tashkend and Khokand on the Sir Darya. A good deal of settlement by immigrants has taken place in modern times, as we shall find also farther north and east in Siberia. The policy of Russian governments has been to allow Russians only to be settlers; and here is a contrast with North America where immigration has been from many different nationalities. The chief commercial product is cotton, and some cotton-milling is carried on. It is noticeable that cotton flourishes considerably farther north here than in North America. Communications are by the Trans-Caspian Railway from the Caspian Sea and by a branch from the Russian railway system in Europe from Orenburg near the southern end of the Ural Mountains. A difficulty with the working of railways in this dry sandy country has been due to the drifting of sand near the line. It is overcome by planting the sands along the railways with vegetation that will flourish in the sand and bind it together with its roots.

#### SIBERIA

Siberia, in the lowlands of the west, ranges, as we have seen, from very fertile plains in the southern part through vast forests to the inhospitable Arctic tundra. Eastern Siberia lies as a whole farther north. It is more difficult country; the open plains are absent; moreover, it is distant from Europe. Western Siberia is therefore more important economically. The mountain belt to the south, bordering the central Asian plateau, is also forested and difficult of access, and has been little settled save where there are rich mineral workings. The coasts of Siberia are of little value to the country—the Arctic for obvious reasons; the Pacific has better natural harbours, but it also is ice-bound for much of the year and the country to which it gives access is difficult and in parts little known. The Arctic coast is at no season free of ice and the river mouths are blocked for more than half the year. Nevertheless, during the few weeks of summer, attempts have been made to open up trade by use of the rivers. It is a peculiarity of the great rivers of

Siberia that, though all open to the ice-bound Arctic Ocean, they are of very great importance as lines of communication through the country. They wind slowly across the western plains, but navigation is often made difficult owing to shoals and to the shifting of channels in floods, which are extensive. The rivers bear harder, generally speaking, upon their right banks than upon their left banks, owing, it is supposed, to the law of deviation due to the rotation of the earth (Part II, p. 477). The right banks therefore are higher and the more suitable for settlement, the left banks being low and liable to flood. The summer rainfall over western Siberia is fairly well distributed throughout the season. If it were not, there would be too little for agriculture; and just as in North America the great wheat fields may be seriously affected by an unusually dry summer, so they may be in Western Siberia.

*Population.*—We are accustomed to think of the inhabitants of Siberia as consisting mainly of (1) more or less primitive nomad native tribes dependent upon sealing and their herds of reindeer, and (2) exiles sent from European Russia in punishment for crime or political opinions. But the free settlers from European Russia are more numerous and more important. They are settled mainly in the western plains, and to some extent in the district at the foot of the Altai Mountains. Eastward to Lake Baikal they are much less numerous. Naturally they are settled principally along the chief lines of communication, the Trans-Siberian Railway and its branches and the rivers. There are also many Chinese in Siberia.

*The Trans-Siberian Railway* and its connexions give through communication between European Russia and eastern Siberia, China, and Korea. From Moscow to Peking is about 6,000 miles. The line follows the fertile lowland of western Siberia with its agricultural and pastoral population, crossing the great rivers, with a town at each crossing. It sends off branches southward to the Altai region, where silver, coal, and other minerals are worked to some extent. Beyond the river Ob the land becomes more hilly and forested; there are many rivers for the line to cross; and it passes through much unsettled country before reaching the town of Irkutsk on the Angara river near Lake Baikal. Thence it rounds the southern end of the lake through difficult country where tunnels are necessary. Hitherto in the long journey from European Russia

there has been none. The line crosses the Yablonoi Mountains at a height of about 3,000 ft. One branch, wholly within Russian territory, runs north of the Amur valley and thence by a tributary southward, and so to the Pacific port of Vladivostok. This line has opened up a rugged, forested, and at first almost uninhabited country, but gold-mining has been established, with something of a timber industry, and coal and iron are known to exist. The other branch of the line enters Chinese territory across the Khingan Mountains at a height of 3,400 ft. and descends to the junction of Kharbin, whence there are connexions to Peking and Vladivostok and to the ports of Korea, from which Japan may be reached with a short sea passage. The Siberian trade which has been opened up by the railway consists largely in pastoral products, especially butter, also in grain, especially wheat, and in furs. It has further encouraged trade with Europe in such Chinese products as silk and the brick-tea used in Russia.

*Comparison of Siberia with North American Lands.*—Comparisons are often drawn between Siberia and the great agricultural lands in North America about the same latitudes. The Siberian forests are more extensive, the lands fit for agriculture probably less so. The similar rainfall conditions as affecting agriculture we have already noticed. The communications with other countries by water are far less favourable in Siberia, where there is nothing to compare with the river St. Lawrence and the Great Lakes of North America. We have also noticed the different system of colonization carried out; in Siberia by Russians almost wholly, in North America by men of many nations. The development of Siberia has been slower and has not advanced so far as that of North America.

#### MANCHURIA AND CHINESE DEPENDENCIES

In Manchuria, to the north-east of China, mountains on the east and west enclose a plain which extends to the shore of the Gulf of Liao-Tung at the head of the Yellow Sea. The plain is fertile where it is sufficiently watered. It is not densely populated, though since the construction of railways settlement by Chinese and Japanese has taken place. The usual food grains are cultivated, and Manchuria in part supplies the far greater population of China

proper. The principal product, largely exported, is the soya bean which yields an oil and is made into bean cake.

The remainder of the Chinese dependencies extend over the central plateau and highlands, and, as we have gathered already, are of little importance in regard to population and products as compared with China proper. The steppe country of Mongolia surrounding the Gobi is sparsely populated by wandering pastoral tribes. From this direction the rich plains of China lay open of old to raiders, and for that reason there was built the famous Great Wall of China, 1,500 miles long, and, from its beginning, over 2,000 years old.

### CHINA

*Physical Features.*—China proper, as distinct from its dependencies, consists of the plain about the lower course of the rivers Hwang-Ho and Yangtse-Kiang, with a hilly or mountainous country surrounding these lowlands on the north, west, and south. Mountains and hills extend from the central highlands eastward between the basins of the two great rivers, so that China may be divided into a northern portion, approximately the basin of the Hwang-Ho; a central, the basin of the Yangtse-Kiang; and a southern, the hill-country to the south of that basin. In the southern division the principal river is the Si-Kiang, which, with many tributaries, flows into the estuary known from the port situated on it as the Canton River.

The plain of China has a coast-line extending between 40° and 30° N. lat., except where it is broken by the hilly peninsula of Shantung projecting into the Yellow Sea. The northern division of China is in great part covered with a fine soft yellow soil called loess, fertile but porous and therefore frequently dry, and deeply cut into ravines by the rivers, from which it follows that irrigation is generally difficult and that nearly every field must have its own well. The Hwang-Ho flows fully charged with sediment with which in its lower course it builds up its bed above the plain level, and it is with difficulty kept within its banks. Sometimes through floods the banks may be broken and the waters spread over the plain. The river has more than once completely changed its course for many hundreds of miles. In one of the worst floods recorded

in modern times it was estimated that more than 1,000,000 people in the densely populated plain lost their lives. In its upper course the Hwang-Ho flows from the central highlands in a devious course and largely through deep gorges. The Yangtse-Kiang has also deep gorges, and its upper course lies through a series of basins tilted backward so that they are well watered and fertile. The gorges connect one basin with another. In its lower course the river is partly fringed with shallow lakes which during the summer, when the river is high with the monsoon rains, receive much of the water and prevent the flooding of the land. When the river is low in winter it is fed from these lakes, which thus become important in keeping it at a sufficiently high level for navigation. The Si-Kiang basin in south China has already been mentioned; here the country generally is hilly or mountainous and communications are not easy.

*Climate.*—As China may be divided into three divisions according to surface so it may be also according to climate. In northern China nine-tenths of the yearly rainfall is brought by the summer monsoon from May to September. In central China, the Yangtse basin, the summer rainfall amounts only to about six-tenths of the annual. Whereas in northern China winter is usually dry, cold, and clear, in southern China the sky is more cloudy throughout the year. The names of provinces in China have mostly geographical meanings; and that of Yunnan, the south-western province, means 'the land south of the cloudy region', that is to say, south of the upper basin of the Yangtse. South China is like northern China in receiving most of its rain in summer, but the rainfall is much heavier. In contrast with the conditions in India, the winter monsoon winds in China from the land toward the sea are generally stronger than those in summer from the sea toward the land. Dust storms raised by the land winds are sometimes so thick as to interrupt navigation even far out at sea. An exception in regard to summer winds is provided by the typhoons which, rising over the Pacific Ocean, may reach the coast of China and cause great damage. The name of typhoon is connected with an Arabic word and this again with a Greek word meaning a whirlwind.

*Vegetation.*—Northern China has a temperate vegetation, and the country is generally open and rather bare in parts as the porous loess soil is unfavourable for the growth of trees. In central China the

vegetation passes into sub-tropical conditions at lower elevations, with bamboo, camphor, and trees yielding vegetable wax ; but temperate forms continue to be found at higher elevations. In south China owing to the same difference of elevation the vegetation is even more varied and in the lowlands such tropical trees as teak and mahogany are found.

*Population.*—The population of China must be at least 325,000,000, which means that there is an average density of population of about 170 over an area of nearly 2,000,000 sq. miles. It is not very evenly distributed, however, some parts of the more mountainous districts being even thinly populated. On the other hand, the whole of the provinces of the plain bordering the east coast have an average density of population exceeding 500 to the sq. mile, and both here and elsewhere, as in the so-called Red Basin, one of the most fertile areas of the upper Yangtse-Kiang, there may be found some of the most densely populated agricultural land in the world, with 2,000 people or more per sq. mile ; and yet these are not what we understand by town populations. Most of the plain is densely populated on the middle Yangtse, where tributaries reach it from north and south. In and around a number of towns of which Hankow is the chief, there is another centre of density ; and in the south another in the basin of the Si-Kiang, around Canton. The population is so large that in spite of the close cultivation of all available land the supply of home-grown food is not everywhere sufficient, and for this among other reasons many Chinese emigrate. Chinese are found spreading over the Indo-Chinese and Malay peninsulas and in the islands of the Malay Archipelago ; and in considerable numbers, so far as they are allowed to do so, they enter the western parts of North and South America and south and east Africa, and are also found in some of the islands of the Pacific. Down to modern times, however, the Chinese, isolated by the highlands of Asia and far distant by sea from European influence, possessing also their own peculiar civilization, which is very ancient, have regarded foreigners with enmity and contempt and have been unwilling to receive ideas from them as to trade, the use of machinery and the development of manufactures. The capital of China is Peking, situated in the north in a position which commands routes leading into China proper from Manchuria and from Mongolia. The

neighbourhood of Peking is not one of the more populous parts of the country, nor is it specially rich in respect of agriculture or natural products; and it has not proved, at any rate in modern times, a particularly good centre for the government of so vast a country. The government of China has long been more or less in disorder; and the remoter parts, such as the mountainous south and south-west and the dependencies of the central highlands, have been little under the influence of the central government.

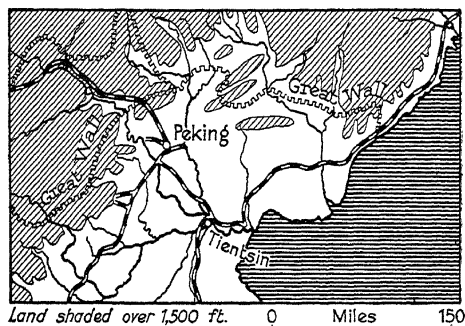


FIG. 65. THE POSITION OF PEKING.

*Agriculture.*—We have gained already an idea of the intensely close cultivation of the more fertile parts of China. As in other agricultural lands, much of the natural forests, particularly in central China, have been destroyed, and damage has resulted to the cleared land from floods against which trees might have served as a protection. With the land closely cultivated there is not much room for pastoral farming except in districts where poor grass-land is found. Donkeys and oxen in the north and buffaloes in the south are usually the beasts of burden. The pig is the most important domestic animal everywhere, for it fends for itself, feeding on any scraps and offal. The cultivated products may be roughly divided as between the northern group, including wheat, beans, and cotton, and the southern group, including rice, tea, and sugar, together with the cultivation of the mulberry tree for the feeding of silkworms; for the production of silk is one of China's principal



industries. Some extension of cultivation has taken place in modern times over the plain of southern Mongolia, which makes something of a parallel to the earlier extension of cultivation over the North American prairies.

*Mineral Products : Commerce.*—The mineral wealth of China is known to be immense, especially in coal and iron, and China is the chief source of the world's supply of antimony, a metal used in various alloys. Tin is worked to a considerable extent in the south-west, inland from French Indo-China. But the development of the mineral resources, owing to the difficulty already explained of introducing new industrial ideas to the Chinese, has not proceeded far ; and the same applies to manufactures connected with the agricultural products. For example, the native silk and cotton manufactures are as a whole primitive, although there are a few modern silk and cotton mills. Similarly, little is done with the mineral working on modern lines, although near Hankow there are large iron and steel works. The principal exports include silk and silk goods, soya beans, tea, cotton, vegetable oils and straw braid ; and the imports, cotton manufactures, sugar, kerosene oil, metals and manufactured goods, rice and flour.

*Ports.*—The coast of the plain has few harbours. That of Tientsin in the north is the port for Peking and the centre for the trade of much of the Hwang-Ho basin. Between this and Shanghai near the mouth of the Yangtse there is no port of first importance. For that reason Shanghai has become the principal port as well as the principal manufacturing centre in China, commanding the trade not only of the Yangtse basin but of part of that of the Hwang-Ho as well. It has an outport for the largest ships at Wusung, and under European influence extensive docks and a large shipbuilding industry have been established, together with flour mills, paper mills, breweries, tanneries, &c. Canton is the chief Chinese port in the south. The British island of Hong-Kong off the mouth of the Canton River has an important position as a collecting and distributing centre for the east generally, and in particular for a large number of ports along the south and south-east coast, each of which is confined by the mountainous interior to a more or less limited hinterland. Most of the principal Chinese ports are known as treaty ports because over the course of years, and often with

difficulty, the consent of the Chinese has been obtained for foreign merchants to trade at these ports. There are also certain ports and small surrounding territories which are under the direct control of Britain and other foreign powers.

*Communications.*—The inland waterways of the Chinese plain are very extensive though not always well kept up. One great canal, seven hundred miles long, extends north and south from Tientsin

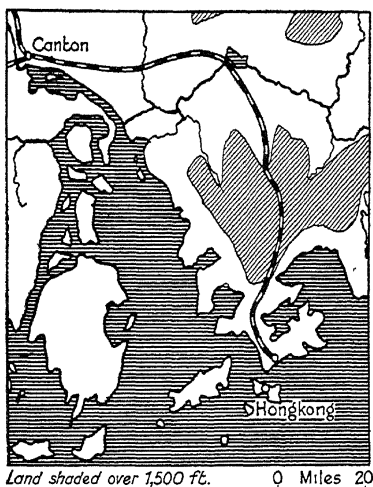


FIG. 66. THE POSITION OF HONG-KONG, the British island-port at the entrance of the estuary leading to the great southern Chinese port, Canton.

across the rivers Hwang-Ho and Yangtse-Kiang to Hangchow, south of the Yangtse. The Hwang-Ho is rapid and shallow, and liable, as we have seen, to shift its channels, and for navigation it has little value. The Yangtse-Kiang, on the other hand, is navigable for ocean-going ships up to Hankow, nearly 700 miles, and the rapids and gorges for over 300 miles farther can be passed in favourable conditions by powerful steamers, though the primitive method of hauling boats by man-power from the banks is still used by the Chinese. The Si-Kiang is navigable for a long way above Canton. In north China there are a few rough roads. In the south,

apart from the waterways, goods are largely carried by men. Railways, introduced into China only in the face of strong opposition, have not been developed very widely in comparison with the extent of the country. A trunk line is completed over most but not the whole of the distance between Peking and Canton, and the capital is also connected with Shanghai, and, as we have seen, with Manchuria and the Siberian system. A few short lines act as feeders to the Yangtse navigation, and there is railway connexion between Yunnan and French Indo-China ; but until the railway system is much farther extended there cannot be much greater development of the mineral wealth of China to which we have referred.

### JAPAN

*The Japanese Empire* includes all the islands from the peninsula of Kamchatka and the southern half of the island of Sakhalin in the north to Formosa in the south, together with some of the oceanic islands in the Pacific ; but the name of Japan is usually taken to cover the large islands of Hokkaido, Nippon—the chief island—Shikoku, and Kiushiu with the adjacent small islands. The empire also includes the peninsula of Korea and bits of territory on the Chinese coast. One of these, including the port of Dairen, has an important position on the Yellow Sea and is connected with Korea, Manchuria, and Siberia by rail. The peninsula of Korea, mainly mountainous or hilly, is inhabited by people related to the Chinese and Japanese but distinct from either. Their occupations are principally agricultural, and beans, rice, and cotton are grown largely, but both coal and gold also are found.

*Physical Features.*—The main islands of Japan have generally smooth coasts, difficult of access, on the west, but on the east the coasts are broken and there are many sheltered inlets. The inland sea between the three southern islands is full of small isles and wonderfully beautiful. The Pacific Ocean is very deep immediately east of the islands, which are themselves mountainous. It is found here, as elsewhere, that where great depths of the ocean front high lands, that is to say, where there are very deep folds of the earth's crust, earthquakes and volcanic conditions are usual ; and so it is in Japan, where slight earth tremors are almost unceasing, and terrible destruction has been caused by large earthquakes many

times. The islands have mountain ranges throughout their length, which send off branches to the west. The scenery is fine, though not very rugged, as the relief of the land has been smoothed by strong erosion consequent upon heavy rainfall. There are several active volcanoes and many others now quiet. The typical form of the volcano, sometimes a nearly perfect cone, is often seen; the finest example is that of Fujisan (or Fujiyama), a sacred mountain, constantly illustrated in Japanese art. It is 12,400 ft. high. Its flanks are cultivated up to about 1,500 ft. above sea-level. Above this there is grass-land to about 4,000 ft.: above, again, forest to 8,000 ft. Beyond this the summit is covered with volcanic ash. None of the mountains reaches the height of permanent snow though they are deeply covered in winter. The land is well watered and there are many beautiful valleys and lakes. The melting snow of spring and the summer monsoon rain brings the rivers down in flood. At other seasons they run nearly dry, and there is hardly any inland navigation. There are many medicinal springs, warm and cold.

*Products and Industry.*—Less than one-eighth of the area of Japan can be cultivated, but the small plains in the lower valleys and the slopes on which terrace-cultivation can be practised are fertile and well watered by the summer rains. Wheat, barley, sugar, and beans are cultivated, together with rice and tea in the southern part of Nippon and the islands farther south. The mulberry tree is grown for the feeding of silk-worms; the camphor tree is important, and also the tree which yields lacquer, for the use of which Japanese artists are famous. There is little room for pasture. The sea fisheries are rich. Coal, copper, and silver are the chief minerals, and kaolin or china clay supplies the famous pottery works of Japan. Limited as the agricultural lands are, they support a very dense population. Both in agriculture and in industry the tendency of the Japanese, as of the Chinese, was, and to a large extent is, to rely upon handwork rather than upon machinery. The Japanese, however, an island people more open to foreign influence than the Chinese, have developed industries to a wonderful extent under European and American influence; and some manufactures upon modern lines, such as the making of matches and machinery, ship-building, and cotton-spinning have been very largely developed. As a result the population tends to become more largely manu-

facturing and less generally agricultural, and the country has to rely to a greater extent upon imported food.

*Communications.*—The chief towns are on or near the coasts, such as Tokyo, the capital, which has as its outport Yokohama ; Osaka with its outport Kobe ; and Nagasaki, one of the principal coal ports. All these ports open eastward. The chief western port is Niigata, but, standing upon a smooth, exposed coast, its shipping is apt to be interfered with by the high winds of the winter monsoon. There is a fair railway system in the principal islands, though the railway routes are indirect owing to the mountainous nature of the country, and gradients are unavoidably steep. Good roads are few and oxen and horses are commonly used as pack animals, while much of the goods in trade are carried by men.

*Formosa*, a mountainous island with a lowland toward the east, has a backward native population, but its agriculture has been developed by the Japanese. Tea and sugar are important products of the island, which is the chief source of the supply of camphor.

#### SOUTH-EASTERN ASIA

*French Indo-China* is the eastern part of the Indo-Chinese peninsula. Its northern district is called Tongking. This comprises the lower part of the valley of the Songkoi river which gives access, and provides a railway route to Yunnan in south-western China. Annam includes the eastward-facing coast with a narrow lowland and forested hills behind it. In the south are Cambodia and Cochin China, which include the lower valley of the Mekong river, flat, and in part marshy. The port of the Songkoi is Haifong, which serves as an outport for the capital, Hanoi, as neither this nor the other rivers are navigable for big ships. Saigon, the chief port in the south, is near, but not on, the Mekong. The north is both an agricultural and a mining district, the minerals including tin and coal. Annam in the centre is important chiefly for sugar and tea. The south is a great rice district, and here, as usual with the rice lands, the population is most numerous.

*Siam.*—The kingdom of Siam consists of the lowland about the delta of the Menam river and the surrounding hills. Rice is grown in the lowland, the hilly forests yield teak, and tin is mined, particularly in the part of the Malay Peninsula which belongs to Siam.

Bangkok, the capital, is at the shallow, silted mouth of the Menam, and, in consequence, is not a port for big ships. Much of the population lives in boats on the river.

*Straits Settlements.*—The British colony of the Straits Settlements includes Singapore, the island at the extremity of the Malay Peninsula, which we have to notice as one of the principal ports in the Far East, with the territories of Malacca and Penang on the Straits of Malacca, facing westward. The small Cocos Islands and

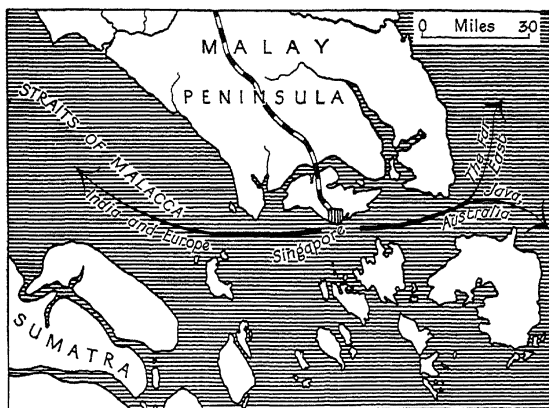


FIG. 67. THE POSITION OF SINGAPORE.

Christmas Island in the Indian Ocean south-westward of the Malay Archipelago are within the Straits Settlements. The governor of the Straits Settlements has official relations with the Federated Malay States, which are four native states on the peninsula under British control; and there are several other small states also protected by Britain. The governor also has official relations with the State of Brunei in Borneo and with British North Borneo, which is under the administration of a company, and Sarawak in the same island, which is ruled by an English Rajah. The Federated Malay States are of first importance for the production of tin and rubber, and large tin-smelting works are established in the neighbourhood of Singapore. The mining and plantations are in great measure supervised by British, but mining has also been developed

by immigrant Chinese, and both here and in the archipelago Chinese and Japanese take leading parts in trade development. It is a natural feature of the Indo-Chinese and Malay peninsulas that the interior and more mountainous parts should be inhabited more sparsely than the lowlands and the coastal districts, and by more backward peoples. The same applies generally to the islands of the archipelago.

*The Philippine Islands*, forming a northward extension of the Malay Archipelago and belonging to the United States of America, are volcanic and subject to earthquakes; and here again, as in Japan, the Pacific Ocean reaches profound depths, over 30,000 ft., or more than the height of the highest mountain in the world. Hemp, named from Manila, the capital and chief port, together with sugar, tobacco, and copra, are important products. Rice and spices are grown, and some gold is found.

*Malay Archipelago*.—By far the greater part of the Malay Archipelago forms, as we have seen, a colony of Holland, and the Dutch have slowly but very methodically developed its trade, beginning from the island of Java as a centre. Here, on the north coast, is situated Batavia, the capital. The island of Java is not the largest; both Sumatra and Borneo are much larger, but Java is by far the most populous. Its area and population nearly equal those of England. Much of it is extremely fertile, and it is less difficult of access and penetration from the sea than the other islands. Both Sumatra and Borneo have wide tracts of marshy lowland, heavily forested, around the coasts. In Java this feature is less marked. It consists of a central mountain chain with several active volcanoes<sup>1</sup> flanked by lowland, along the north side almost entirely; on the south, only here and there. The north, the more accessible coast therefore, opens toward the sheltered seas within the archipelago; the less accessible south coast faces the open Indian Ocean. Sumatra has mountains along its western side but extensive lowlands eastward towards the Strait of Malacca and the Java Sea. Highlands extend throughout the centre of Borneo and radiate toward the coasts, the highest mountains being in North Borneo. Java may be said to be in full commercial development; it yields many tropical products, including tea, coffee, sugar, rubber, tobacco,

<sup>1</sup> On volcanoes, and in particular the famous island-volcano of Krakatoa, see Part II, p. 438.

cocoa, rice, and cinchona for quinine. In minerals it is not rich. The commercial development of Sumatra has not reached the same level but is nevertheless important. In addition to the agricultural products, of which coffee, and, in the north, tobacco, may be specially noted, its minerals are important, including coal and oil. The small islands of Banka and Billiton to the east of it have yielded great quantities of tin. Borneo and Celebes are the other islands where development is principally though slowly progressing. The Molucca Islands to the east of Celebes are known also as the Spice Islands from the products for which they have been famous since the archipelago was first visited by Europeans.

*Burma.*—The western piece of the Indo-Chinese peninsula is the territory of Burma, mountainous in great part, and in the valleys and lowlands often marshy. It is a difficult country and was for long sparsely inhabited by backward and hostile peoples, but when brought within the Indian Empire it became settled and the population was largely increased by immigration from India and elsewhere. Communications are naturally difficult, but the river Irrawadi is navigable for steamers for 900 miles, and railways connect Rangoon, the principal port, with the upper part of its valley and with Mandalay, the chief town in the interior, on the river Sitang. The lowlands of Burma yield rice, and the forests of the interior teak, which can be floated down the rivers. Rubber, petroleum, coal, and tin are among other products, and there are famous ruby mines, one of which yields the finest rubies known in the world.

## INDIA

*Physical Features.*—The ranges of hills which border Burma on the west, overlook the north-eastern end of the plain of northern India. This plain terminates in the delta region of the Ganges, a district of dense jungle known as the Sundarbans. The delta region is entered also by the river Brahmaputra, the lower valley of which forms an eastward continuation of the plain between the Himalaya and the hills of Assam. The Brahmaputra, as we saw, breaks through the mountains from the Central Asian plateau in a series of deep gorges just beyond the northern border of India. From its valley westward and north-westward for a distance of 1,800 miles to the Hindu Kush, the mighty wall of the Himalaya Mountains fronts the Indian plain.



A wall it is commonly called, and with reason, for there are few clearer natural boundaries in the world, but it is a wall from a 100 to 200 miles thick from the mountain crests to the plain. The intervening region, known familiarly as 'the Hills', is one of high ridges and deep valleys, magnificent to see. The gorges of the Brahmaputra form no important route through the mountains to the plateau. The Chumbi valley carries the principal road into Tibet from India, giving access to Lhasa, the capital of Tibet, in one of the most fertile of the high valleys of the plateau. Until modern times access to this city was forbidden to foreigners. The

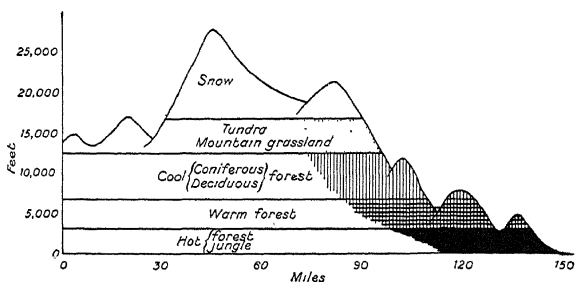
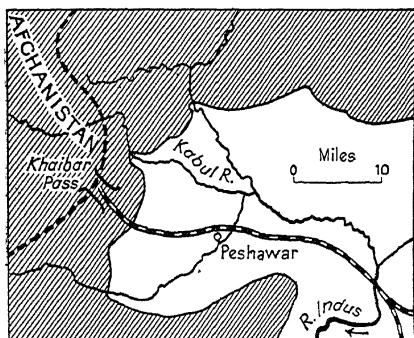


FIG. 68. Section and vegetation diagram of the Himalaya about long.  $87^{\circ}$  E.

pass is at approximately  $90^{\circ}$  E. long., and from here westward to  $75^{\circ}$  E., in the mountain territory of Kashmir, there are very few passes across the mountain crests. The vegetation of the Himalaya shows the regular transition according to temperature conditions, from the snow-line about 17,000 ft. downward through alpine and high mountain vegetation, to coniferous forests merging into deciduous forests, which pass into warm-temperate conditions and finally to thick tropical jungles at the foot toward the Indian plain. This plain, belonging to the Ganges basin in the east and that of the Indus in the west, reaches a height up to 1,000 ft. on the divide between the two basins. The soil is alluvial and exceedingly fertile, but although with the rains the green of the rich crops and vegetation quickly appears, during the dry season the plain is brown and dusty and the villages of mud dwellings merge into the prevailing drab colouring. The upper part of the Indus basin is the Punjab, a name meaning

'five rivers', from the streams which water this part of the plain and of which the principal are the Indus itself and the Sutlej. Beyond the plains to the west rise the hills of Afghanistan and Baluchistan, inhospitable lands inhabited by people difficult to control, who have many times been tempted to raid the more fertile lands of the plain below them and must be kept in check by the British administration, sometimes necessarily supported by force. The north-west frontier of India has been the scene of the most difficult work of protection, as it is entered from the west by the Khaibar Pass, the principal entry into India from this direction. A railway



*Land shaded over 2,000 ft*

FIG. 69. PESHAWAR and the Khaibar pass and railway.

runs through this pass, from the Afghan frontier, connecting it with the city of Peshawar, from which there is connexion with all India. The principal pass into Baluchistan is the Bolan, which leads to the town of Quetta in Baluchistan and also is served by a railway. The plains are bordered on the south by rugged hills frequently covered thickly with jungle, but in the west in Rajputana more bare and dry as the desert of Thar is approached. This desert and the lower Indus valley carry the plain southward to the coast of the Arabian Sea, so that the plain is open to the sea at both ends. The plateau of the Deccan, or peninsular India, rises steeply from the west coast in the ranges of the Western Ghats, rough forested slopes standing above a narrow coastal strip of cultivated lands without any large cities south of Bombay, 'the good bay' as

its name signifies, which provides the principal western port of India. In the north of the peninsula the rivers Narbada and Tapti open to the Gulf of Cambay, and the Tapti valley gives a line of communication eastward and access to an important agricultural region of the plateau, where the black soil of volcanic origin which occurs in several parts of the plateau is most extensive and richest. It is this soil which is especially good for the cultivation of cotton in India. The long slope of the plateau eastward to the Bay of Bengal is drained by many rivers of which the principal are the Mahanadi, the Godavari, and the Kistna. Their basins contain many fertile tracts separated by wild jungly hills of which those toward the east are sometimes known generally as the Eastern Ghats. These, however, are more broken and less high than the Western Ghats and lie farther back from the sea, so that there is on the east a fairly wide coastal lowland with sandy shores unbroken except by river-mouths, and fringed in great part with lagoons behind the shore-line. The lowlands are closely cultivated and the lower slopes of the southern hills grow tea, coffee, and rubber, while the upland forests of the south contain teak, sandalwood, and other valuable timbers. The jungles of the plateau are full of wild life, and the Indian elephant when tamed is a most valuable animal to man in various kinds of heavy work. Toward the south of the peninsula the hills are cut across by the Palghat Gap, which gives access from the west coast to the east. From the south-eastern extremity of the peninsula a chain of islets called Adam's Bridge carries a railway across part of the strait which separates the island of Ceylon from the mainland.

*Climate.*—A common division of the Indian climate is into the cold season, from October to March, the hot season from March to June, and the 'rains' from June to October. A more accurate division is into a cold season during January and February, a hot season from March to the middle of June, the general rains of the rainy monsoon from the middle of June to the middle of September, and the period of the retreating monsoon when the rains gradually cease, from mid-September to December. Except in the high mountains the term 'cold' as applied to the Indian climate is only comparative with the temperature at other seasons, for none of the Indian lowlands or the plateau has the extreme winter cold which is

found, for example, in northern China. The Himalaya forms a barrier against the extreme cold of Central Asia. January is generally a fine and cloudless month, though in the north-west some rain is brought by depressions coming from westward, this rain being important for the wheat which is grown as a winter crop in the Punjab. The heat of the hot season is intense, preventing work at mid-day and necessitating careful protection against the sun. All vegetation is dried up and the air is full of a dust haze. In south India the heat of the day is somewhat less intense than farther north, and the air is less dry. The rainy monsoon arrives during June so suddenly that the common phrase is, 'the monsoon has burst'. As the rains are brought, broadly speaking, by two main streams of wind, one of which strikes the Western Ghats and the other passes from the Bay of Bengal across the northern plain, it follows that the heaviest monsoon rains are found on the western slopes of the Western Ghats and in the eastern part of the plain. The rainfall of the plain lessens as the distance from the Bay of Bengal increases, until in the west we reach the desert where rain hardly ever falls. The rain east of the Western Ghats is very much less than that on the western slope. There is, as it is said, a very well-marked 'rain shadow' to the east of these hills. The heaviest known rainfall in the world occurs at Cherrapunji in Assam,<sup>1</sup> situated where a range of hills extends east and west from the mountains of the Burmese border, a depression opening to the south-west between them. The wet winds from the Bay of Bengal pass up this depression as up a funnel, and in doing so precipitate the tremendous rainfall for which this locality is noted, although others not far away, on the farther side of the hills, have nothing like the same amount. The temperature during the rains is not so high as during the preceding hot season, but the moist air is trying for Europeans. The retreat of the rainy monsoon, as has been stated, is gradual, and rains are over in the Punjab about the middle of September, in Bengal early in October, on the middle western coast at the end of October, and on the south-eastern coast during November or December.

Typhoons are not uncommon in the Bay of Bengal when the air is in an unstable condition at the time of the advance of the monsoon, and still more at the time of its retreat, and these

<sup>1</sup> Figures are given in Part II, p. 490.

storms sometimes cause terrible damage on the east coast. Apart from the north-west the areas most liable to drought are, as may

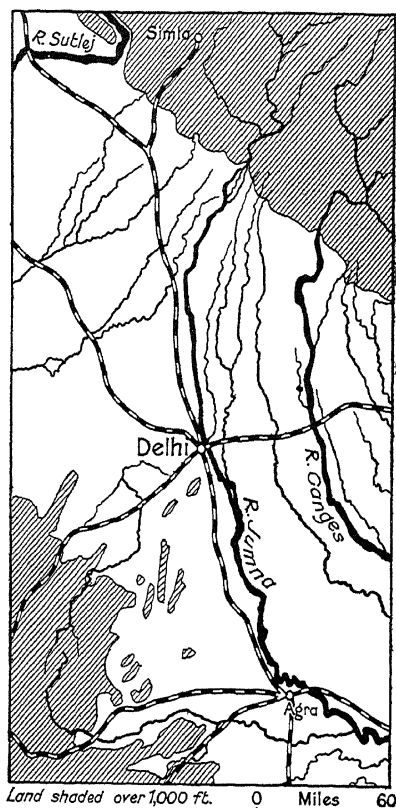


FIG. 70. THE POSITION OF DELHI near the low divide between the Ganges and Indus basins.

be expected, in Central India and farther south on the plateau to the east of the Western Ghats, and also in the interior of Burma. India, with its large population dependent upon home-grown crops for food, has frequently suffered from famine, especially in one or

another of these regions, but under modern conditions of transport and under British administration the danger of this is greatly reduced, as food can be imported from regions not afflicted by famine. The severity of the hot weather in the lowlands causes Europeans to move, if they can, in the hot season, to high places, going, as it is

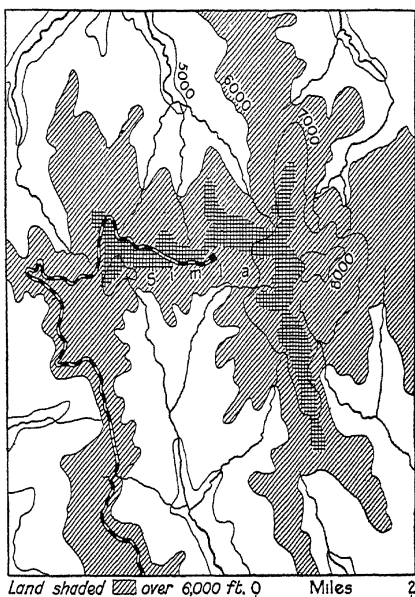


FIG. 71. THE POSITION OF SIMLA (the town being shown by the cross-lining), on its hills, 6,500 to 8,000 feet above sea-level. The railway is seen following closely the contours of the hills in its climb to the town.

called, 'to the hills'. In the Himalayan region and elsewhere there are hill stations, of which the principal is the town of Simla, almost due north of Delhi, the capital of India, which stands near the low divide between the Ganges and the Indus basins. Simla is practically the hot-weather capital of India, for the centre of government is moved there at that time of year. Its elevation is from 7,000 to 8,000 ft. above sea-level, the temperature bearable and pleasant for Europeans, and the scenery wonderfully beautiful.

*Population.*—The area of India, including Burma, is over

1,800,000 sq. miles and the population 320 millions. These figures are comparable with those for China, but in India there is a greater number of different peoples and in different parts over fifty languages are spoken. Moreover, the various native peoples reach every level of civilization, from those who take important part in the administration of the Empire down to the uncivilized and little-known peoples of the remoter parts of the Deccan, some of whom are considered to represent an aboriginal population before India was invaded, as it was many times from other parts of Asia, by more advanced peoples. In the matter of inhabitants at a low scale of civilization the parts of India already mentioned may be compared with the Andaman Islands south of Burma, which are inhabited by a primitive race who have come little into contact with other peoples. The inhabitants of India have also many religions, of which the principal are the Hindu and Mohammedan. About five-eighths of the total population are Hindus and one-fifth Mohammedan. The ancient social and religious practices of the people remain alongside of the modern industrial conditions and system of government introduced by the British, for the British administrators have kept a careful regard for the native customs. India consists, as to more than two-thirds, of territory under direct British administration divided into provinces, and as to less than one-third of native States each under its own Prince, tributary to the British Government or in alliance with it. The British King is the Emperor of India.

India is most densely populated (1) in the northern plain, especially the eastern part of it ; (2) along the east coast ; (3) in the south-east lowlands; and (4) along the west coast, especially around and north of Bombay. The population is least dense in the hills, the north-western desert, and the jungly mountains of the Deccan.

*Products and Commerce.*—Nearly three-fourths of the male population is engaged in agriculture. The principal exports are products of agriculture, including cotton, jute, seeds (principally oil seeds), rice, wheat, and tea. Millets and pulses are very widely cultivated, but mainly as food crops for the people themselves. The export of cotton is mainly from Bombay. It is grown on the plains in and east of the peninsula of Kathiawar. It is also a leading crop from the black soil of the Deccan, principally in the north-

west. Cotton mills have been established in Bombay and Ahmadabad and elsewhere, principally in the Bombay Presidency. The cultivation of jute is carried on for the most part in Bengal and Assam, and jute mills are found in the neighbourhood of Calcutta. Rice is

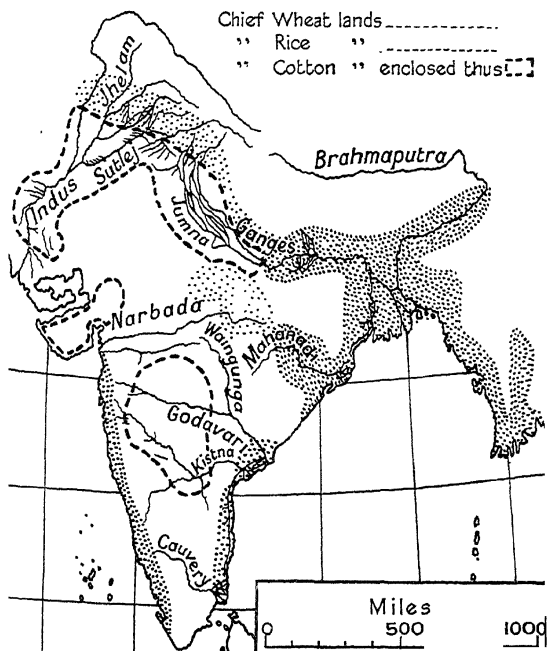


FIG. 72. WHEAT, RICE, AND COTTON IN INDIA. The marking of many water-ways together, as in the Indus and Ganges basins, shows the districts where irrigation is specially important.

a characteristic crop of the great deltas and the narrow coastal belt of the west, but in respect of rice exports Burma is the most important division of India and its supply is drawn upon if the crop fails and famine threatens in any of the rice districts of India. Over one-third of the total acreage under wheat is in the Punjab with its fine system of irrigation by canals. Wheat is also grown to some



extent farther east in the northern plain and in the northern parts of the Deccan. Of the export of tea, nine-tenths comes from Assam and eastern Bengal. A great variety of vegetables, fruits, and spices enter into Indian agriculture. The south-west coast lands are noted for pepper, the eastern slopes of the Western Ghats for coffee, and other products important locally are the opium poppy and cinchona for quinine. Coal and iron are fairly widely distributed. The most important coal-field worked is in the hills bordering the plain

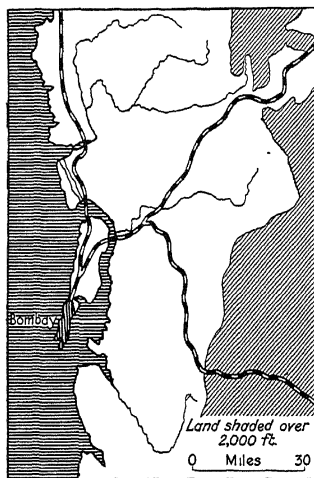


FIG. 73. THE POSITION OF BOMBAY.

west of Calcutta. There are gold-fields of some importance at Kolar in the Deccan, and elsewhere. Important workings for petroleum and tin have been developed in Burma. Besides the cotton and jute and other industries developed on modern lines but on a more limited scale, the native handicrafts of India are famous in several directions, such as those of brass and copper ware at the city of Benares, the pottery of Sind in the lower part of the Indus basin, and the making of carpets and Kashmir shawls.

*Communications.* — Under British administration India

has been given a good railway system, partly on standard gauge, where there is sufficient traffic, partly on narrow gauges in districts where trade and traffic are smaller. The four chief ports are Bombay and Karachi in the west, Calcutta and Madras in the east. Bombay and Calcutta are the two largest by far, and also are the most populous cities in India, each having over a million inhabitants. Bombay, much nearer to Europe than Calcutta, since the making of the Suez Canal, has railway communications all over India but serves in particular the northern Deccan and the central and western parts of the northern plains. Calcutta, on the Hooghli, one of the distri-

butaries<sup>1</sup> of the Ganges kept open for navigation by dredging and embanking, is the leading port for the eastern part of the plain, including Bengal and Assam. Madras, centrally situated on the south-east coast, owes its position rather to the ease of landward communications through the Palghat Gap and up to the Deccan plateau than to any favourable approach from the sea, for there is no natural harbour anywhere on this low, sandy, eastern coast; and an artificial harbour has been constructed at Madras only with great difficulty. Karachi in the north-west, near the delta of the Indus, is the outlet for the basin of that river and exports in particular the wheat of the Punjab. The other great cities of India are mostly in the Ganges basin in the northern plain. Out of a dozen of the largest cities only Hyderabad, the capital of the State of that name in the Deccan, and Ahmadabad to the north of Bombay, are not in the northern plain. Among the chief cities so situated in addition to those already mentioned are Lahore, Lucknow, Bangalore, Cawnpore, Benares, and Agra.

*Ceylon*.—The island of Ceylon, south-east of the Indian peninsula, forms a separate British colony. It is flat in the north, mountainous save for a coastal belt in the south. Both coastal and mountain scenery is very beautiful, with rich and varied tropical vegetation; for there is rain at all seasons, the island being near to the equatorial region of constant rainfall. The chief products include coco-nuts and copra, rice and tea, and some plumbago is worked. We have already observed the important position of the island and of its chief port, Colombo, in relation to sea routes.

<sup>1</sup> For 'distributaries', and on deltas generally, cf. the Nile, p. 252, and Part II, p. 457.

## EXERCISES

1. Draw maps or diagrams to show the direction of winds over south-eastern Asia and Australia in (a) summer ; (b) winter. Add notes describing the distribution of rainfall at these seasons, and account for the seasonal change in the direction of the winds.

2. Outline the physical features of Asia, with special reference to (a) the northern plains ; (b) the central plateaus and mountain ranges ; (c) the southern peninsulas.

3. Contrast the climate and physical features of Arabia with those of Indo-China, and show how these influence the occupations of the people.

4. What is meant by 'inland drainage' ? Select any example from Asia and describe the chief features of the area.

5. Describe the course of either the Yang tse-kiang or the Hwang-ho. What use is made of these rivers ?

6. Describe and account for the positions of the chief hot deserts of Asia.

7. Account for the dense population of the lower Ganges basin, and the scantier population of the Deccan.

8. Define the situation of the following ports and discuss the advantages and disadvantages of each for trade : Bombay, Colombo, Singapore, Smyrna, Madras.

9. What are the chief exports of the ports mentioned in question 8 ?

10. Give examples of monsoon types of climate outside Asia, and describe the conditions causing them.

11. In what other parts of the world do you find regions similar to the Asiatic regions of Tundra, Steppe, and Taiga ?

12. What parts of Asia produce rice, cotton, tea, jute ? Explain the conditions which enable each of these crops to be grown.

13. Describe a journey from Leningrad to Vladivostok. Describe the character of the country passed through. Illustrate by sketch map.

14. Show on a map the railway communications between Asia Minor, Palestine, and the Persian Gulf.

15. Locate the following towns, and account for their importance : Quetta, Kabul, Bagdad, Aden, Tiflis, Teheran, Delhi.

16. Explain why Java is the most densely populated island of the East Indies.

17. Describe the tin-mining industry of the Malay Peninsula and Archipelago.

18. Give reasons to account for the dense population in the valleys of the Yangtse and Hwang-ho rivers.

19. Explain why Peking, Shanghai, Hankow, and Canton have grown to importance.

20. Japan is sometimes called the ' Britain of the East '. Why is this ? Give an account of the agricultural industry of Japan.

21. By what different routes may one travel from London to Tokyo ? Describe one of these routes in detail.

22. Draw a map of northern India (north of  $20^{\circ}$  N.) and indicate the highlands, river systems, and chief railways.

23. Why is irrigation essential in India ? Point out the systems of irrigation used in different regions.

24. Contrast life in the Tibetan plateau with life in the Indo-Gangetic plain. Account for the differences you note.

25. Give an account of the chief products of any of the following : Burma, Siam, the Moluccas, Formosa, Ceylon.

## VII. AFRICA

*Outline.*—The continent of Africa is bounded on the north by the Mediterranean Sea, on the west by the Atlantic Ocean, and on the east by the Indian Ocean and the Red Sea. The area is  $11\frac{1}{2}$  million sq. miles. Africa is connected with Asia by the isthmus of Suez, 80 miles wide, at its north-eastern extremity. The outlines of the continent are simple. The Equator cuts almost across its middle: its northernmost point is in  $37^{\circ}\text{N.}$ ; its southernmost in  $34^{\circ}\text{S.}$  But the Equator does not equally divide the area, for Africa is much wider to the north of  $5^{\circ}\text{N.}$  than to the south. About that latitude, the western coast, as you follow it from the north, bends east. In drawing a sketch map we may begin this eastern bend near long.  $10^{\circ}\text{W.}$ , and carry it to near long.  $10^{\circ}\text{E.}$ , then the coast runs south again. It is nearly parallel with a line joining the northernmost point of the continent (Cape Blanco) and the southernmost (Cape Agulhas); and fully two-thirds of the total area of the continent lies east of that line. The central meridian for the map may be taken as  $20^{\circ}\text{E.}$  The westernmost and easternmost points, Cape Verde and Cape Guardafui, are not far from the same latitude,  $15^{\circ}\text{N.}$ , and Cape Agulhas,  $20^{\circ}\text{E.}$  long., is not far from midway in longitude between the western and eastern points, Cape Verde being about  $17^{\circ}\text{W.}$ , and Cape Guardafui about  $51^{\circ}\text{E.}$  It is rather easy, in drawing the sketch-map, to exaggerate the narrowness of the continent in the south, as compared with its width in the north. The east-and-west stretch of the western coast about  $5^{\circ}\text{N.}$  equals roughly two-thirds of the width of the continent at the Equator.

Looking at a simple physical map of Africa, probably two points will be noticed as specially remarkable in comparison with other continents. The first is that the coasts are very regular and unbroken. Africa has some 16,000 miles of coast line; Europe, only one-third the size of Africa, has nearly 20,000. For an illustration, we have only to contrast the African and the European shores of the Mediterranean Sea. The second point is that there are no very wide lowlands bordering the coast. We notice some big rivers—the four to catch the eye are the Nile in the north-east, the Niger in the west, the Congo in the middle, and the Zambezi in the south.

None of them flows over wide low plains like those of the Amazon or the Mississippi in the Americas. On the other hand, we do not see many very high mountains. There is a mountainous region extending north and south of the Equator in east Africa; but there is no great mountain system like those of the Rockies in North America, the Andes in South America, the Himalaya or the systems of central Asia. This suggests that the continent of Africa has the form of a plateau or tableland, though that is a very broad statement, of course.

*The 'Dark Continent'.*—But these two facts—the regular coast, and the plateau form—are closely connected with the fact that Africa was for centuries, and sometimes still is, called the Dark Continent. It was 'dark' because, until within the memory of people now living, very little was known about the interior. In the days of man's early civilization in the Mediterranean lands, there was a rich, powerful people settled in Egypt along the lower Nile, but that flows through uninhabitable desert. And that desert, known generally as the Sahara, extends right across northern Africa. When Cretans, Phoenicians, Greeks, and Romans of early and classical times came across the Mediterranean to northern Africa, they could nowhere penetrate far before they found the desert barring the way south, unless it were along the Nile valley. That part of Africa which borders the Mediterranean was almost cut off from the rest of Africa, and to a great extent it still is so. Then when men began to sail the great oceans, they travelled around the coasts of Africa, indeed, and landed on them at some points; but it was not easy to do this, for few natural harbours are found, sheltered from the sea, and always it was difficult to get toward the interior. The slopes of the plateau made a barrier; the rivers were found to break

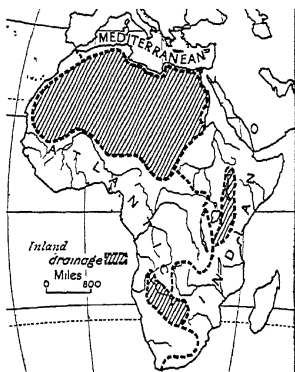


FIG. 74. OCEANIC DRAINAGE AREAS OF AFRICA.

through the edges of the plateau, with rapids impossible to navigate ; the narrow coastal belt is often marshy and unhealthy, or covered with 'bush' or forest hard to pass. From the fact that the Equator crosses the middle of the continent, and that by far the greater part of the land lies between the Tropics, we gather that the climate must

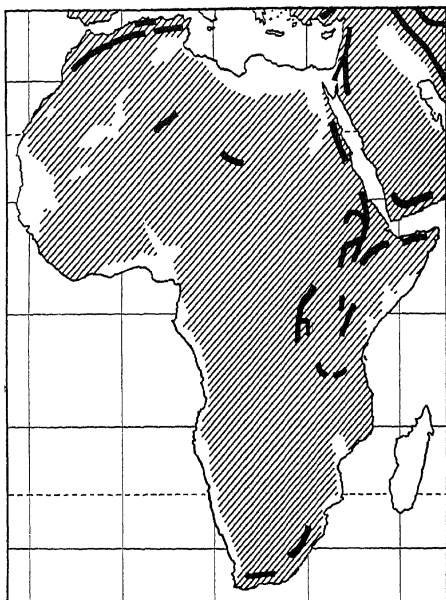


FIG. 75. GUIDE TO PLATEAUS (shaded) AND HIGHLANDS (black) OF AFRICA.

be hot generally, and in many parts it is hard for white men to bear it. These are features for which we must watch in our description.

A British reference-book, published about the year 1800, summarized all that was then known of Africa in a few lines. Among other points, it was mentioned that 'the government is mainly despotick, and the inhabitants black'. And Fig. 76 illustrates, in a general way, what was known of Africa about the year 1850—not much, it will be seen. But after that time exploration was carried on all over the continent. Native governments may have been 'des-

potick'; but the people did not, as a rule, form powerful civilized states, and the principal European states shared most of the continent between them. In this matter of political geography Africa is unlike the other continents: there are only three independent

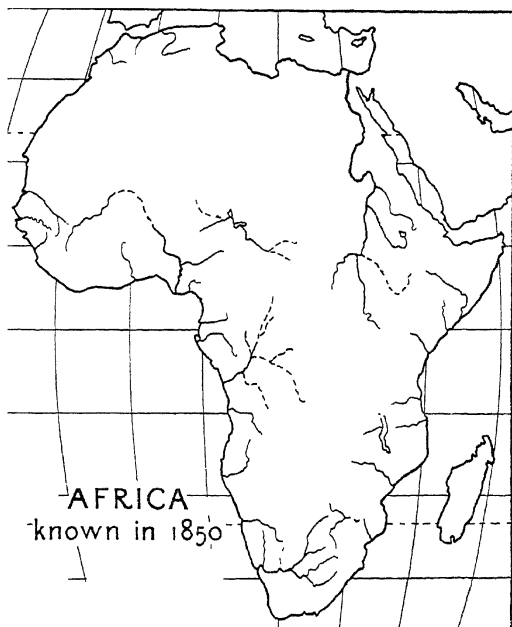


FIG. 76. This map illustrates the small knowledge of Africa so lately as 1850. The broken lines show, for example, that much of the course of the Niger was uncertain, the Congo hardly known, the great lakes (excepting part of Nyasa), and much of the Zambezi, unknown.

states in the whole continent; the rest is divided between the British Empire, France, Belgium, Portugal, and Spain, and governed in various ways which we shall have to consider presently.

*Surface Divisions.*—Africa can be divided into nine physical divisions, and to have the map of these clear in the mind is to have taken a good long step toward a knowledge of the general geography of the continent.



(1) The Atlas region in the north-west, a mountainous land bordering the Mediterranean Sea, cut off by the desert from the rest of the continent, but having many features like those of the other lands, European and Asiatic, which surround the Mediterranean.

(2) In the north-east, the valley of the Nile, which in its lower part cuts across

(3) The great desert of the north, the Sahara with its extensions.

(4) The Sudan, extending from the Atlantic Ocean to the Red Sea, and including most of the Niger Basin and the middle Nile valley.

(5) In West Africa, the coastal region of the Gulf of Guinea, the eastward incurve of the coast (p. 246) just north of the Equator.

(6) The basin of the Congo.

(7) The highlands of Abyssinia.

(8) The east African plateau and mountain region with its great lakes and rift valleys, and the eastward slope to the shore of the Indian Ocean.

(9) The plateau of South Africa, including the basins of the Zambezi and other large rivers, and the southern desert of Kalahari.

*Physical Features.*—Within these various regions there are great areas where the scenery is not varied, and many who have travelled only in one part of Africa have called the country monotonous. So it is in this sense; but between one region and another there are the greatest possible differences. At one end of the scale we have the scanty vegetation of the Sahara; at the other, the dense tropical forest. The intermediate types of vegetation are well marked, as we shall find after considering the climate of the continent, which largely controls them. The surface of the plateau lands is a good deal broken in many parts, either by steep-sided river-courses, or by isolated hills rising steeply from the general level. These are so common a feature over large parts of south and west Africa that there is in German geography a special term for them, meaning island-hills, because they stand up from the plateau like islands from the sea. A Dutch word used in South Africa, *kopje* (koppie) is better known to us.

Another important point which strikes us on our first physical survey is that the northern and western plains of Africa—that is, principally, the Saharan desert region, the Sudan, and the Congo

basin—lie at lower levels generally than the eastern and southern plateaus. One of the principal exceptions to this condition is found in our first division—the Atlas region in the north-west. This region is in a physical sense distinct from the rest of Africa, but closely related to south-western Europe, from which it is divided only by the narrow Straits of Gibraltar ( $8\frac{1}{2}$  miles wide) connecting the Mediterranean Sea with the Atlantic Ocean. The Atlas mountain system may be broadly divided into two parts: the maritime part, or series of ranges standing close along the Mediterranean coast, and an inland series of ranges. The sea-coast along the maritime ranges is generally steep; for reasons which we shall presently find, the coastal slopes and the narrow valleys opening between the hills to the sea are fertile and have a rich vegetation. The Rif district, best known perhaps for the lawless nature of its inhabitants, is included in this division in the west; and to the east the series of fertile valleys, within the coastal ranges, are known under the general name of the Tell. Between the maritime and the inland ranges are high plateaus, dry for the most part, but containing shallow lakes called *shotts*, which have no outlet but are kept restricted and made salt by high evaporation. Toward the east these plateaus fall away sharply to a district behind the Gulf of Gabes, which also contains salt *shotts*, but lies, in part, below sea-level. Westward, the land becomes less inhospitable as it slopes more gradually toward the Atlantic coast. The inner Atlas ranges are higher than the maritime, and reach an extreme height of about 15,000 ft.

*The River Nile.*—The north-east part of Africa is traversed, from south to north, by the middle and lower course of the Nile, one of the most famous rivers in the world. For 1,800 miles above its mouth it flows through land which on either side of its narrow valley is desert, and from which it receives no tributary. But its extreme head-waters are far to the south, some of them beyond the Equator, in lands which are not desert, but receive plenty of rain, and when we come to consider the climate of Africa we shall see how the rain seasons, over different parts of the upper basin of the river, keep the river flowing, throughout the year, so that even during that long passage through the desert it does not dry up. Therein lies its fame—in the fact that it makes fertile the land of Egypt, through which in its lower course it flows. For that reason (among others)

Egypt was in earliest history the home of a powerful people. Later we must see also how in modern times the skill of man has helped the river to do still better work in fertilizing the land.

The most distant head-waters of the Nile are on the western side of the Mufumbiro Mountains, on both sides of the Ruwenzori Mountains, and in the rivers flowing into Lake Victoria (in central Africa). From Lake Victoria the Victoria or Somerset Nile flows with a rapid course, passes over the Ripon and Murchison Falls, and through lakes Kioga and Albert. The stream below Lake Albert is called the White Nile. Passing through the Sudan, where vast plains are traversed, the river flows slowly, and is apt to be blocked with masses of floating plants, called *sudd*. Two large tributaries are received, the Bahr el-Ghazal from the west and the Sobat from the south-east, after which the river continues through a rather dry steppe country, intermediate between the wet region to the south and the desert to the north. At the town of Khartum the Blue Nile joins the main river from Lake Tsana in Abyssinia; to the south-east and farther north again the river Atbara is another important tributary from the Abyssinian highlands. The importance of the rainfall upon these highlands in maintaining the waters of the Nile in Egypt will be seen later (p. 264). Below the confluence of the Atbara there are no more tributaries, and it is only along or near the banks of the river that the land, otherwise desert, can be made fertile by the waters and settled and cultivated by man. From Khartum downward as far as Assuan the Nile descends at intervals over rocky ledges in strong cataracts, of which there are six (known usually as the Sixth Cataract, below Khartum, and so on down to the First Cataract at Assuan). Below Cairo, the capital of Egypt, the single broad stream of the Nile divides into a number of distributaries—these are streams flowing from the main river, the opposite of tributaries, which flow into the main river. These distributaries spread over a triangular tract of country, the base of which is the Mediterranean coast. This tract is called the delta of the Nile, being named from the Greek capital letter  $\Delta$ , *delta*, which illustrates the shape of the tract, but upside-down as compared with the map. From this delta, other tracts, through which rivers send distributaries to the sea, are called deltas also, though they are not always so exactly of the form of the letter  $\Delta$  (compare, for instance,

the Mississippi). A delta is built of sediment brought down by a river into a sea in which tidal or other currents are not strong enough to carry all the sediment away : the main channel tends to become blocked, and the river-water to find its way out by new channels. New land is always being added by such a river around its mouths, and along the coast of the Nile delta there are half-finished stretches of mud and marsh where the land is being built out by the river into the sea.<sup>1</sup>

*The Sahara.*—The desert of the Sahara borders the Atlantic coast in the west ; on the east it passes into the Libyan desert which extends to the Nile ; east of the Nile are the Nubian desert and the dry hills which border the Red Sea. The desert belt of the Old World in the northern hemisphere extends through Arabia, and, with little interruption, far into the heart of Asia (p. 198). Northward, in Africa, the desert begins south of the Atlas ranges, and farther east from the very shore of the Mediterranean. Southward it passes gradually into the grass and scrub lands of the Sudan. The desert is in great part sandy (for reasons, as we shall find, connected with the conditions of climate, as the existence of the desert is also). It is crossed by many dry valleys ; such a valley is known, from an Arabic word, as a *wadi*. There may be some moisture in them occasionally, or water may be found below the surface. Sometimes, for example, where the high plateau of the Libyan desert falls away to a depression between the Gulf of Sidra and the Nile delta, water comes to the surface or can be reached by shallow wells, and there is formed an oasis, which is a classical Greek word and means a fertile tract surrounded by desert. The higher plateau lands of the desert are often rocky and stony, not sandy. In the midst of the desert there are extensive highlands, with mountains said to reach 8,000 ft. in height ; these regions are not entirely dry. They are little known : it is still even possible for a novelist to write mystery stories about them ; though generally speaking writers can no longer draw upon their imagination for tales of unknown Africa, as even so recent an author as Rider Haggard could—so fully has most of Africa been explored in modern times.

*The Sudan.*—The region of the Sudan lies, as we have seen, south of the desert and, like it, extends from the Atlantic on the west, to

<sup>1</sup> See further, Part II, p. 457.

the Red Sea on the east between the Nubian desert and the highlands of Abyssinia. It consists mainly of extensive plains, with no high mountains, though in the centre there are highlands (p. 255) from which those of the Sahara extend north-westward. In the west the Sudan is watered by the rivers Senegal and Gambia flowing westward to the Atlantic, and by the Niger. The Senegal is the first river which breaks the dry west coast for 900 miles from the Atlas region in the north-west. Between the mouths of the Senegal and Gambia the African coast reaches its westernmost point in Cape Verde. The Senegal has a mouth liable to be blocked by sand. The Gambia is a comparatively short but wide and important river in its lower course ; it descends from the plateau in rapids about 280 miles upstream. Both these rivers and the Niger have their sources in the highlands of Futa Jallon, which rise behind the coast where it turns south-eastward toward the Gulf of Guinea. The Niger flows in a wide curve north-east and then south-east, before it enters the sea near the head of the gulf. Fed by heavy rains in the highland of Futa Jallon, it stores its waters in lakes and marshes, and then, at the northernmost part of its curving course, borders the desert and receives no tributaries. After turning south-east, however, it enters a wet region, and receives many tributaries, the largest being the Benue from the east. The Niger passes by rapids over a series of rocky ledges before entering its plain track and reaching the sea through a marshy delta of many streams.

East of the Niger basin is the basin of Lake Chad, which is one of inland drainage, as none of its water flows to the sea, and it is the largest such basin in Africa. It receives rivers from the south, and some of its waters flow away to lose themselves in marshes, but the lake is known to be decreasing in size, gradually drying up, and becoming filled with sand, wind-borne from the desert to the north. Farther east the Sudan extends across the middle part of the Nile basin, being traversed from west to east by the Bahr el-Ghazal.

*West Africa*, south of the savanna of the Sudan and north of the Gulf of Guinea, contains fairly high and open country, including the Futa Jallon highlands, sloping southward to a belt of thick forest, and finally to a low swampy coast. The highlands are broken by the valleys of several considerable rivers flowing south, such as the Volta, and the valley of the Niger interrupts them entirely. At the

head of the gulf is the partly mountainous district of Cameroon, in which Cameroon Peak rises to 13,800 ft. It is the highest point in a volcanic belt (but the volcanoes are extinct) which begins in the chain of islands, including San Thome, Principe, and Fernando Po, in the Gulf of Guinea, and extends across Africa, in the southern part of the Sudan, to the bend of the Nile between Khartum and Dongola.

*The Congo Basin.*—Southward from Cameroon, highlands extend fairly close to the coast, though the coastal belt itself continues low. About 6° S. lat., the highlands bear the name of the Crystal Mountains, and these are broken by the series of narrows through which the great river Congo passes before entering the sea. It does this through a single mouth, forming no delta, since its current and those of the ocean prevent its silt being deposited about the mouth. The narrows of the Congo, through which the river falls steeply and flows rapidly, form the only outlet of a vast basin, extending from 5° N. of the Equator to 12° S. of it, and

draining in the east a part of the mountain region and some of the great lakes of east Africa. The basin has a slightly undulating surface, but the main Congo river and some of its tributaries descend with rapids at certain points from step to step of the plateau; the connexion between this plateau and communications along the river is important (p. 281). Much of the basin is thickly forested (p. 268). It is enclosed, generally speaking, by higher ground all round, although a marked depression occurs where the basins of the Congo and Lake Chad approach most closely. The Congo basin lies generally higher than that of the Amazon in South America, with which later we must

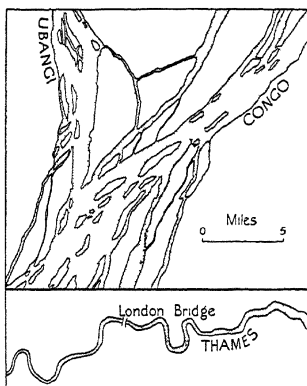


FIG. 77. A part of the Congo in its middle course, at the junction with the Ubangi. The size of the rivers, spreading out into many channels around wooded islands, may be compared with that of the Thames at London.

compare it (p. 341); the Congo basin is rather a depression in the African plateau than a low plain. In the north-east, between the Nile and Congo basins, the plateau falls rather sharply toward the Congo basin levels, though 'appearing mainly as a series of monotonous plains with no well-defined crest. Along the east is the rampart of the central African mountains; but at the north of Lake Tanganyika the basin encroaches on the Tanganyika plateau and continues northwards across the region between Lakes Tanganyika and Nyasa, includes the swampy area around Lake Bangweolo and Lake Mweru, and then embraces the high plateau region of Katanga'.<sup>1</sup> This last is a continuation of the High Veld, a division of the South African plateau (p. 259).

The Congo basin is watered by a very large number of rivers tributary to the main river, and many of these bear different names in different parts of their courses. The main river does this also. Its most distant head-stream rises as the Chambezi, south of the Tanganyika plateau, and passing through Lakes Bangweolo and Mweru is known as the Luapula: it joins the Lualaba to form the main stream of the Congo. A feeder of the Congo drains lakes Tanganyika and Kivu. The principal northern tributary is the Ubangi, which in its upper course is called the Welle.

*The Eastern Highlands.*—To the north-east and east of the Congo basin rises the most mountainous region of Africa. The northern part of this region is the Abyssinian highlands, in which the greatest heights exceed 15,000 ft., and the plateaus from which these summits rise are broken by precipitous valleys, sometimes 4,000 ft. deep. The ravines are full of jungle; the plateaus open. In the midst of these highlands lies Lake Tsana, the source of the Blue Nile, a pear-shaped lake some forty-five miles across. East of the Abyssinian highlands, toward the Red Sea and the horn of Africa which ends in Cape Guardafui, there is the Somali country of dry hills falling to a sandy coast; a land of little use.

South of the Abyssinian highlands is the East African plateau and mountain regions. From the west of the Indian Ocean, low and marshy, the land rises in terraces through a dry, unhealthy belt, to high plateaus broken, in lines running generally north and south, by depressions and mountains. The main depressions are known

<sup>1</sup> Certificate Geographies: *Africa*, by P. E. Lewin.

# RIFT VALLEYS OF EAST AFRICA AND THEIR LAKES (left unshaded)

*Highest land bordering rifts  
over 6,000 ft. ....* ■

Miles  
0 100 200 300

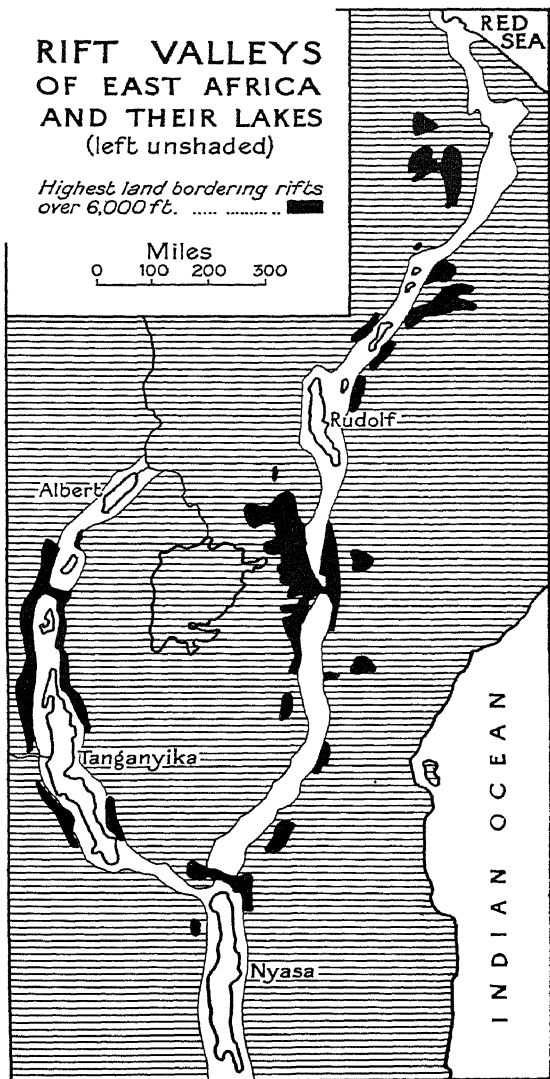


FIG. 78.



as the East African rift valleys, while the eastern is regarded as part of that rift which extends along the valley of the Jordan, the Gulf of Akaba at the head of the Red Sea, and that sea itself (p. 213). It is traced south of the Abyssinian highlands to Lake Rudolf, a lake without outlet, and thence east of Lake Victoria, and so to Lake Nyasa. North of this lake the eastern valley converges with another to the west, which, traced northward, contains Lakes Tanganyika, Kivu, Edward, and Albert. (See Part II, p. 432.)

Of the three largest lakes in this region, Victoria belongs to the Nile basin, Tanganyika to that of the Congo, Nyasa to that of the Zambezi. While Tanganyika and Nyasa are rift-valley lakes, long, narrow, and very deep, Victoria, wider and shallower, is not. Tanganyika and Nyasa are each about 350 miles long, and about 50 miles wide at the most; Nyasa has a greatest known depth of 2,300 ft.; Tanganyika of over 4,000 ft. Victoria is no deeper than 270 ft., but in area it is the biggest lake in Africa—nearly 27,000 sq. miles, or about the size of Scotland. Among mountain-ranges in this region are Ruwenzori, rising, with snow-covered peaks on the Equator, to 16,800 ft., and Mufumbiro, with active volcanoes. Other great mountains rise almost isolated to the east of Lake Victoria, such as Kilimanjaro (19,300 ft.), with glaciers upon its highest slopes, and Kenya (18,600 ft.). If you should come upon the name of the Mountains of the Moon, it may be to these, or possibly to Ruwenzori, that it refers; it was given by the Roman geographer Ptolemy (born in Egypt), who lived in the second century A.D., to mountains which he believed to stand above the sources of the Nile, and as he made that river flow from two great lakes it seems that stories of equatorial Africa must have been passed along, by traders or others, to the shores of the Mediterranean. Yet Lake Victoria was not seen by a modern European till 1858, nor the mountains of Ruwenzori till thirty years later than that; so long did central Africa remain 'dark'.

*The South African Plateau* extends southward from the highland between Lakes Tanganyika and Nyasa, and the uplands in which the southern head-waters of the Congo take their rise. Here also are the sources of the Zambezi, which flows east to the Mozambique Channel of the Indian Ocean; and the divide between the Congo and Zambezi basins is not well marked. The middle part of the

Zambezi basin forms the high region of Rhodesia, little of which is less than 3,000 ft. above sea-level. The Shire highlands south of Lake Nyasa, the Matoppo Hills south of the main river, and other elevations overlook the high-lying Rhodesian plains. Like other African rivers the course of the Zambezi is broken by falls or rapids where it passes over terraces of the plateau. The highest of these are the famous Victoria Falls, where the river, over a mile wide, plunges some 450 ft. into a gorge scarcely 500 ft. wide, nearly at right angles to the course of the river above it. From the north the Zambezi receives the river Shire, descending from Lake Nyasa, and it enters the sea through a delta encompassed with mangrove swamps.

The next great eastward-flowing river to the south is the Limpopo, which reaches the Indian Ocean in Delagoa Bay. Between the middle courses of the Zambezi and the Limpopo rise the Matoppo Hills, and between their lower courses there is a low coastal region rather wider than usual.

Westward of the Zambezi and Limpopo basins there is a dry country, in the north of which Ngami and other swampy lakes belong to an inland drainage area, while farther south, about the Tropic of Capricorn, is the Kalahari Desert, the southern counterpart of the Sahara, though of much smaller extent. The South African plateau south of the Limpopo is under 4,000 ft. high only in the valleys of rivers, the chief of which are those of the Orange and its tributary the Vaal. The plateau rises from the sea in a series of terraces, forming undulating lands, broken here and there by kopjes. The highest grassy tablelands are known as the High Veld: *veld* is a Dutch word

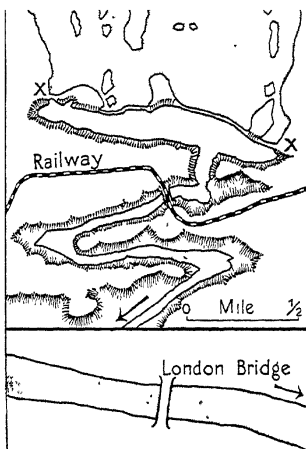


FIG. 79. THE VICTORIA FALLS OF THE ZAMBEZI. They extend between the points x-x, and the width of the river above them, and below where it is compressed into a wonderful gorge, is compared with that of the Thames at London Bridge.

probably meaning 'field', and given by the Dutch who were the first Europeans to settle in this region. As the land falls eastward toward Delagoa Bay the High Veld gives place to the less open Bush Veld. To the south the veld is enclosed by a rampart of mountains, of which the Drakensberg (known shortly as 'the Berg' in the locality) has summits over 11,000 ft. The scenery is very fine; the mountains are sheer to the east with deep ravines and magnificent falls. To the south are the terraces of the Great and Little Karroo. This name is corrupted from a native (Hottentot) word meaning dry and barren, and describes the state of these terraces for the most part. Lower ranges of hills rise between them and the coast, and the characteristic flat summit is illustrated by the famous Table Mountain above Cape Town.

*Climate.*—We have found that Africa extends to an equal distance north and south of the Equator, therefore we find similar climate belts north and south. In central Africa, about the Equator, there is a hot wet belt with rain at all seasons. Farther north and farther south there are belts in which summer is the wet season and winter the dry. Farther, again, there are the regions which are always dry, so that we have the Sahara Desert in the north and the Kalahari in the south. Finally, along the north coast and in the south-west we find the type of climate which is called Mediterranean, with wet winters and dry summers. But differences are caused between the climate belts of the north and the south because there is a wider extent of land in the north than in the south; in the north there is the great land-mass of Europe and Asia close to Africa, whereas in the south the continent is surrounded by ocean. Again, there are differences in the height of the African plateau in the north and in the south. The differences of climate between the narrow low coast-land and the higher plateau inland are always well marked. As the continent does not extend very far beyond the Tropics in either direction there is no part of it where the climate is cold, except on the highest mountains. As to the distribution of rainfall: in the equatorial region there are two periods in the year at which the rainfall is heaviest, as the sun passes overhead in its apparent northward and southward passage. Other months are less rainy, but there is no dry season. In the tropical belts north and south of the Equator there are at first still two wet periods, but they approach

more closely as we go north or south ; and the winters, when the sun is less high, are more definitely dry seasons, until at the north and south of the northern and southern belts respectively there is

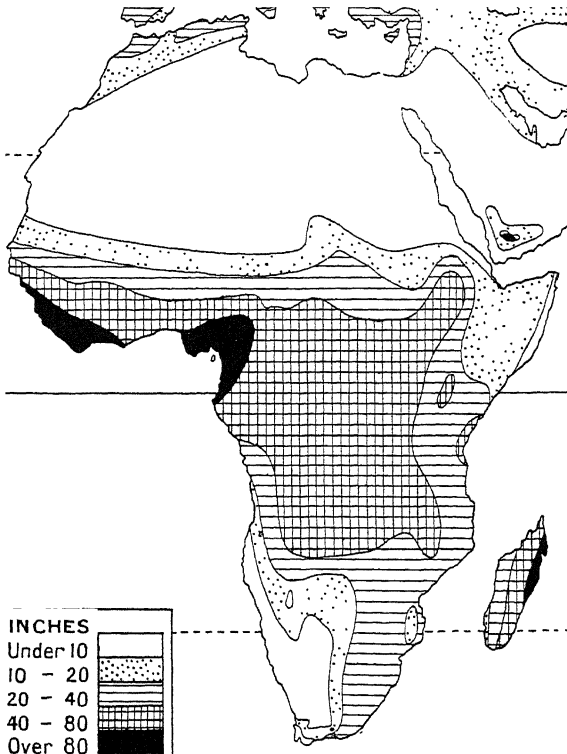


FIG. 80. MEAN ANNUAL RAINFALL OF AFRICA.

one wet season only. This is in the summer months, about June to August in the north and about November to January in the south.

Along the coast of the Atlas region bordering the Mediterranean Sea we have the Mediterranean climate which is under the influence of the north-east trade winds in summer. These are dry in this

region because they pass over the wide extent of the land-mass of Europe and Asia, and moving from a cool to a warmer belt become still more dry. In winter, however, the Mediterranean region is under the influence, not of the trade winds, but of the westerly winds which bring rain. The rainfall decreases, generally speaking, along the African Mediterranean coast from west to east ; so that while on the Algerian coast there may be an average rainfall of about 30 in. in the year, on the Egyptian coast there is only, on an average,

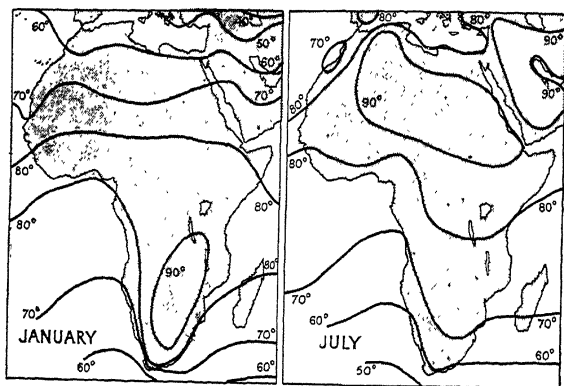


FIG. 81. ISOTHERMS (temperatures reduced to sea-level).

about 8 in. The Atlantic coast at the north-west of the continent is influenced by a cold ocean current, the Canaries Current, which keeps the air cool in comparison with the desert interior and causes much fog but a small rainfall. The Mediterranean influence does not extend far inland because of the high Atlas Mountains in the north-west, while in the east the desert approaches close to the coast and in parts even touches it. The Sahara, being continually under the influence of the dry trade winds, receives little or no rain at any time. The sky in this region is generally clear with little cloud, there is much sunshine, and the heat in summer is as great as any in the world ; the bare ground becomes intensely hot, and the condition of the air above it causes by reflection that strange appearance of water and of trees and other objects, which is known as the mirage. Owing to the clearness and dryness of the air the heat is quickly

radiated when the sun has set ; therefore the range of temperature between day-time and night-time is often very great, and in winter frost is not uncommon. While there is danger from the sun's rays to people who are not accustomed to the intense heat, the climate

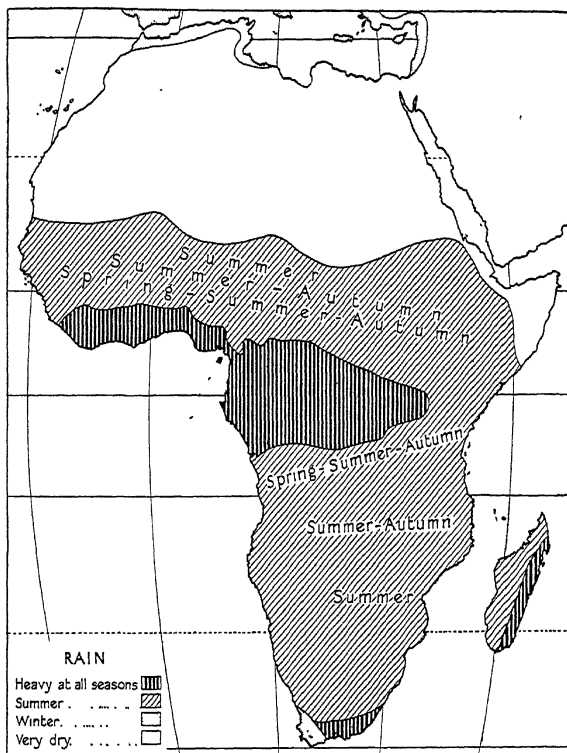


FIG. 82. SEASONAL RAINFALL IN AFRICA.

is not unhealthy. Dust storms, the dangerous Simooms, sometimes overtake travellers through the desert. Dry as the greater part of the Sahara is, the mountains in its midst receive some rain owing to their height, and have running streams of water, and snow is said to lie sometimes upon their summits in winter.

From the western Sahara southward through the Sudan we pass

through a region where the rainfall, at first scanty, becomes heavier to the south until the country around the Gulf of Guinea is reached. The climate of much of this region is hot and oppressive, and so difficult to bear for those white men whose work takes them there that they are as a rule allowed leave for long periods to return to their own home country, and do not work in west Africa past middle age. There is in this region at the foot of Cameroon Mountain a rainfall average which is the second highest known in the world, exceeding 400 in. More generally the coastal rainfall ranges from 70 to above 100 in. in the year. There is still a well-marked dry season in the winter, and over much of the western part of the region, nearly to the coast, a north-east wind called the Harmattán commonly blows, which although laden with dust and bringing a good deal of discomfort is nevertheless known as 'the doctor' because it brings healthier conditions than those of the summer heat. The prevalent wind at other times is the south-east trade wind, deflected after crossing the Equator, and blowing from south-west. It passes over the warm waters of the Guinea Gulf which wash this part of the Atlantic shore.

Over the Congo basin we find equatorial conditions of climate, with a very small range between the mean temperatures of the warmest and coolest months, but a daily range which is much greater. There is rain at all seasons. The basin, extending both north and south of the Equator, has rain from March to November in the north, with a dry season from December to February; in the centre the full equatorial rain system, with plenty of it at all seasons, but two periods about April and October when it is heaviest; and in the south a dry season from June to September. The northern tributaries of the great river therefore receive rain at a different season from those of the south, and so the waters of the main stream are always kept at a high level. The climate is extremely damp and for white men uncomfortable. It is cloudy and misty for the greater part of the day and much of the rainfall comes with thunderstorms and is very heavy.

A great part of East Africa has monsoon winds and rain in summer; thus Abyssinia receives its heaviest rains from June to October, and these are the rains which are most important in causing the floods of the Nile which bring fertility to the lower valley of the river in

Egypt. These rains are less heavy than those which water the higher part of the Nile basin on the east African plateau; that region is within the equatorial belt of rain at all seasons. In Abyssinia the rain falls, as we have seen, in a few months; and it is on that account that the Nile at Khartoum, after running low from about November to May, begins then to rise quickly, and reaches its greatest height about August and September. The region about the horn of east Africa (Cape Guardafui) is very dry because the south-west or rain-bearing monsoon blows along and not across the coast to the south of the horn, while the north-east monsoon coming over dry Arabia also brings no rain. Farther south in east-central Africa we find again the equatorial arrangement of two periods of heaviest rainfall, one lasting from about February to May and the other from October to December. In some parts these seasons are known respectively as 'maize rains' and 'millet rains' from the two crops which they help to grow. The temperature here varies greatly according to elevation, so that while at the coast it is hot and unhealthy, just as in the west, in the interior it is so temperate in parts as to be suitable for white men to settle, as we shall find later. Always the range of temperature between the seasons is small though the daily range may be great. Mount Kenya and the other high mountains in this region well illustrate the effects of different conditions of climate at different heights. On the wet southern slope of Mount Kenya there is a forest belt extending from its base at about 5,000 ft. up to 12,000 ft., whereas on the drier northern slope there is much grass-land within that belt. Above 12,000 ft. there is pasture-land with meadows like those called *alp* in the Alpine region. Above this again is a belt where only mosses and lichens grow, while about 16,000 ft. the region of permanent snow is reached, and on some of the mountains glaciers are found.

From the Congo basin southward we pass through a transitional belt in the west between the rainy Congo basin and the dry region of south-west Africa. In the south-west, as we know, there is the Kalahari Desert; but this is not so extensive as the Sahara nor does it extend right across the continent, which is narrower here, and on the eastern side is under the influence of the rainy monsoon in summer. Nor is the Kalahari itself wholly without water. The dry region in south-west Africa is not excessively hot, because its coast



is washed, as the north-west is, by a cool current. This southern cool stream is called the Benguella Current. The air at the coast is damp and fog is common; yet there is little rain, and in winter winds of the föhn type descending from the interior sometimes raise the temperature above that of the summer. Over the plateau of Africa south of the Zambezi the summer, when the sun is at its farthest southward movement, is a season of high pressure with fine and dry weather. From this distinction, however, we have always to except the south-western 'mediterranean' region about the Cape of Good Hope, which has already been mentioned. The region generally is noted for its clear skies and plenty of sunshine, although breezes raise much dust from the veld and heavy thunderstorms are not uncommon in the summer. Temperature is much the same over the whole of the plateau, because the plateau is generally higher in the north than in the south, and this balances the natural increase in mean temperature from south to north. Over the southern part of the plateau, however, frost is not uncommon from May to September, and sometimes has serious effects for agriculture, and especially fruit-growing, in the early spring, i. e. in September. The south-east coast lands below the plateau have a warm climate influenced by the southern fringe of the warm equatorial current, in contrast with the cool stream along the opposite south-west coast. The south-east trade winds bring a fairly heavy rainfall, mainly in summer, as far as the southern curve of the coast.

*Vegetation.*—The Mediterranean type of vegetation is found along the Mediterranean coast and north-west Africa so far as the country has sufficient rainfall. Its valleys and slopes towards the sea are fertile, with olives, oranges, and vines and all the cultivation of the European coasts of the Mediterranean Sea—with which, as far as concerns climate and vegetation, this part of Africa is much more closely connected than with the rest of the continent. On the hills there are belts of forest, including cork, oak, and cedars, and the vegetation generally is evergreen. This belt nowhere extends far inland to the south because the ranges of the Atlas prevent Mediterranean conditions from extending far in that direction, and mark off these conditions rather sharply from the high dry plateaus between the ranges. These consist of bare, dry steppes which, however, in some parts, bear the useful esparto grass. Along the southern edge

of the Atlas and farther east there are deep valleys and oases with sufficient moisture to bear groves of palms, gardens, and orchards; but to the south of this the great desert of the Sahara has very little vegetation. The water-courses, which, although dry on the

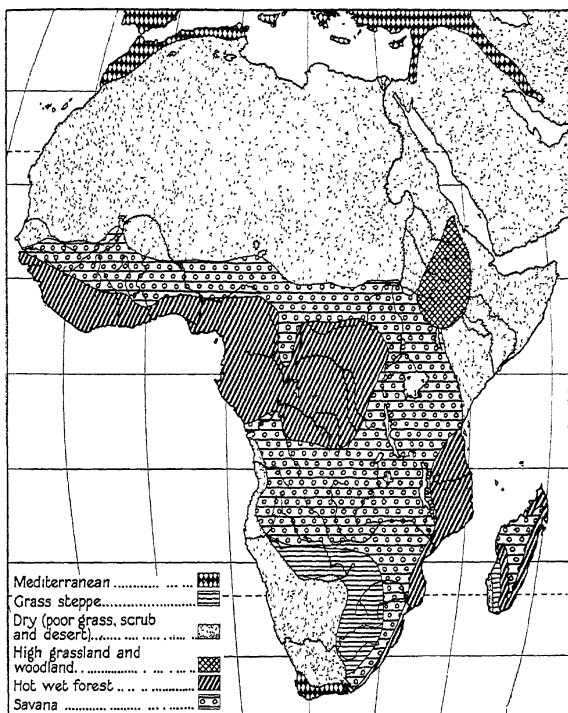


FIG. 83. NATURAL VEGETATION OF AFRICA.

surface, have a little moisture beneath, are sometimes clearly marked by low bushes each standing apart by itself. Few wells and oases break the dryness of the desert. The Nile valley, however, may be regarded as the chief oasis of all, and a wonderful region it is, a narrow ribbon of fertility extending right across the desert, bearing plentiful crops, and supporting the closest population in all Africa.

From the south of the Sahara the belt of half-desert country of scrubby and thorny vegetation extends, gradually improving, into the grassy country, with open belts of trees, often spoken of as park-land and also known by the name of savanna. This is a name given originally by Spanish explorers to the open plains of tropical America, and may be derived from one of the languages of the natives whom they discovered there. It has come to be used of all tropical grass-land of this sort. The savanna in Africa extends right across the continent in the Sudan and passes south across the Equator in the region of the Great Lakes, to broaden westward again in the southern part of the continent, and to extend behind the tropical woodlands of the east coast very nearly to the southern end of the continent.

Within the horseshoe thus roughly traced is enclosed the equatorial forest which borders the Guinea coast of West Africa and covers a great part of the basin of the Congo, which lies within the belt of heavy rainfall. At its fullest development this hot wet forest is so thick with tall trees and dense undergrowth that man can scarcely live in it. Nevertheless it contains valuable plants which yield oil and rubber, and important timber trees such as those which give us ebony and mahogany. The dense forest is not everywhere continuous within the Congo basin. Between the valleys of the principal rivers it is broken by belts of lighter woodland and open country of the savanna type.

The east coast and tableland show successive stages of vegetation as the climatic conditions and the elevation vary. The horn of Africa in the east, as we have seen, is a dry country, into which the thorn and scrub vegetation extends from the southern edge of the Sahara. From this dry region Abyssinia rises into cool highlands with a heavier rainfall, with open grassy country on the higher slopes and tablelands, interrupted by deep valleys, some of which are thickly wooded, so much so that the population is mostly on the open uplands. In east-central Africa and farther south there are found the mangrove swamps along the coast which are typical also of the western central coasts and other such coast-lands elsewhere in the world. Behind this there may be, on the wettest lower slopes of the plateau, hot wet forests like that of the west. These are separated by lighter woodland and savanna, which also are found higher up

the plateau. The savanna, as we have seen, covers the greater part of the plateau except where the dense vegetation of marshes replaces it around the low shores of some of the lakes, such as Lake Victoria.

Southward from the basin of the Zambezi the savanna vegetation becomes gradually less tropical, and the subtropical type of the Bush Veld is found. Farther south again the High Veld is almost or entirely without trees. The dry country of the west, including the Kalahari Desert, is not entirely without water and vegetation. It extends far to the south-west and south, where the terraces below the High Veld known as the Great and Little Karroo receive little rain, and have a scrub vegetation with queer ugly plants growing fleshy stems and leaves, such as are common in other half-desert regions, where plant life in order to survive must store what water it can in its leaves or bulbous roots. In the extreme south-west about the Cape of Good Hope the Mediterranean type of vegetation appears again, for the reason we have already found connected with the climate ; while in the south-east, where the trade winds bring the summer rainfall to the coast-land and the margin of the plateau, vegetation is subtropical and fairly rich. On the lower slopes there is a good deal of beautiful light woodland ; on the upper slopes, park-land or grass-land.

*Animals.*—Africa is well known as a home of big game. The savanna is the region where the greatest number of large animals is found, such as antelopes, giraffes, and zebras, together with lions, leopards, rhinoceros, and elephants, and many other forms. On the savanna these big creatures have a free range. In the dense forests there are fewer, though the elephant is found in parts, and there too are found several kinds of apes which are adapted to tree-climbing. As many parts of Africa have been developed in modern times by white men or under their guidance, big game has been driven off and much reduced in numbers ; so far that in some African countries there are now game ‘ reserves ’ and strict laws as to the number which hunters may shoot. But for this, some kinds of animals would be wholly destroyed. The two wild creatures perhaps most useful to man are, as it happens, both types of the desert, not of the savanna or the forest. These are the camel and the ostrich, both of which have been domesticated, the camel for man to ride across the desert, and also to provide him with milk, flesh, and hide ; and the ostrich

to be kept for its fine feathers. In many parts of Africa, however, especially the tropical savanna region, there are certain kinds of insects which carry the germs of disease both to cattle and to man. The most dangerous of these are different sorts of the fly called tsetse, which, besides making it impossible to keep cattle in some parts of central Africa, carry also to man a deadly disease known as sleeping sickness. In many parts of Africa, also, the mosquitoes which breed in marshes and stagnant water carry malaria to man ; but both these diseases, and many other complaints from which men suffer especially in tropical countries, have been made much less serious than they were formerly, through the skill of research workers into the ways of preventing and curing them. There are other insects which are a nuisance to man in other ways ; such as the termite, or so-called white ant, which destroys woodwork unless it can be prevented, and, in South Africa especially, the locust, which from time to time arrives in vast clouds and may destroy all the vegetation of large tracts of country. Poisonous snakes are common, especially in the forests, though as a rule less so in Africa than in other hot lands.

*Population.*—Over a great part of Africa there are not natural barriers such as high and continuous ranges of mountains which might prevent communication, and therefore the native population is for the most part a good deal mixed in origin. Moreover, east Africa is in easy communication with Asia, and especially with Arabia, where the Arabs are accustomed to travel through the desert and have in the past been forced to do so when they became too numerous for their own poor country to support them. All over Africa, therefore, from the Mediterranean as far south as the tropical forests, and still farther south along the coast, there are many Arabs or people who are of partly Arabian origin. Again, in the north, the Berbers of the lands bordering the Mediterranean and the *fellahin* or peasants of Egypt are among the Hamite peoples whose origin is supposed to be Arabian or western Asiatic. The name of Africa was very probably borrowed in Roman times from one of the Mediterranean tribes of these people. To this day the name of Africa in the Arab tongue is only applied to the country of Tunisia in north Africa, although in European use it has been gradually extended to cover the whole continent. The Arabs of northern Africa are an aristocracy wherever they are found. They are traders as

distinct from cultivators like the Berbers and the *fellahin*. In the settled lands and in the desert they are nomads (or wanderers) and warriors. The inhabitants of the Sudan are a good deal mixed in origin with both Arab and Hamite, but broadly speaking it may be said that the natives of Africa south of the Sahara are almost wholly of negro type. The Arabian and Hamite influences have not got into the central forest, so that the purest negroes are probably found in that region ; but in east and south Africa there is generally to be traced some amount of foreign (Asiatic) blood. The negroes north of the line running from Cameroon to Lake Albert and the coast to the east speak many languages ; but to the south of that line, where, except through the forests, communication has been easier, all languages belong to a single type called Bantu. These, it is true, differ much in different parts ; and one of them, the Swahili tongue, has borrowed words from various foreign languages spoken along the coast, including English, and has become a common speech for the traders of different nationalities who frequent that coast. Many of these are Arabs, many Indians. At Cape Town and in the south-east there are Malays.

There are, further, in certain parts of Africa, strange peoples who are believed to have their origin in races which inhabited Africa before the negro entered it, and have been greatly reduced in numbers and driven by the invaders into the most difficult parts of the country. Such are the Pygmies of the central forests, who live the most primitive life on what they can get out of the forest. Such also are the Bushmen, the short, yellow-brown hunters in the east and south of the Kalahari country, and the few inhabitants of the poor pastoral lands which fringe the south-western desert. These peoples do not practice agriculture because their lands are not fit for it ; but the African negro generally is an agriculturist and often quite skilful ; while in the pastoral countries where it is possible to keep cattle, especially in the Sudan and in South Africa, the native riches are reckoned in cattle.

*Political Division.*—In those parts of Africa where communications are less easy, as in the thick forests of the west, the negroes live in villages, each of which has its own government under a headman. Elsewhere a chief may have authority over a whole tribe, and where communications are less difficult there are or

have been native states. The independent states remaining now are the kingdom of Egypt (though this was until lately at first under Turkish rule and then under British administration); Abyssinia, which is a territory kept independent by being isolated and surrounded by desert or half-desert country; and Liberia, on the west coast, which is a negro state founded, not by African natives, but by other negroes freed from slavery in America. The rest of Africa is for the most part in the possession of European states; or at least the native states are under the influence of some European power. The sultanate of Morocco, in the north-west, is mainly under French but partly under Spanish protection (p. 277).

*The British Empire in Africa* forms a wide belt of territory extending from the southern frontiers of Egypt to the Cape of Good Hope, and there are other British territories in west and in east Africa. Southward from Egypt the Anglo-Egyptian Sudan extends from the coast of the Red Sea on the east, westward into the desert and southward over the basin of the Bahr el-Ghazal, and includes a large part of the basin of the upper Nile. Southward from this the territory of Uganda reaches to Lake Victoria and is bounded on the east by the colony of Kenya. Both of these are bounded to the south by the territory of Tanganyika. Both Kenya and Tanganyika have a coast-line on the Indian Ocean. Next to the south again the Nyasaland Protectorate borders the western and southern shores of Lake Nyasa and reaches nearly to the Zambezi. Rhodesia is an extensive territory to the west of this, including the head-waters of the Congo and the upper basin of the Zambezi. To the south extends the territory of the Union of South Africa, with other territories under British administration. In west Africa the Empire includes four separate territories; those of Gambia bordering the river of that name, Sierra Leone, the Gold Coast, and Nigeria; and in east Africa British Somaliland borders the Gulf of Aden.

*Non-British Territories.*—French territory in Africa is principally in the north-west, extending from Algeria southward over the desert to French Guinea, the Ivory Coast, and Dahomey bordering the north coast of the Gulf of Guinea, and to French Equatorial Africa which includes most of the country called Cameroon and borders the right bank of the Congo over part of its lower course. France has also a small territory in east Africa on the shore of Bab el-

Mandeb Strait, with the port of Jibuti, which is the principal entrance to Abyssinia. Italy possesses the territory of Libya (Libia) between the French territory in the north-west and Egypt, with that of Eritrea bordering the Red Sea north of Abyssinia, and that of Italian Somali-

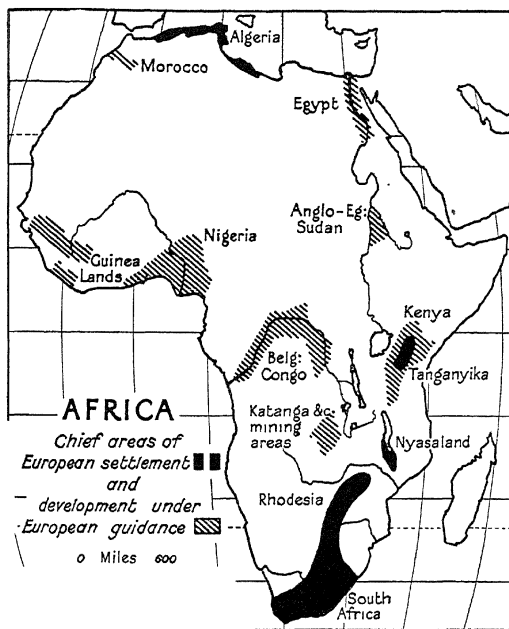


FIG. 84. From comparison with a political map in the atlas it will be seen that areas of European settlement are mostly within British territory.

land extending along the coast between the horn of Africa and Kenya. Belgian Congo covers most of the basin of the Congo. Portugal has a scrap of territory in the west, south of Gambia, and larger territories farther south—Portuguese West Africa, also called Angola, and Portuguese East Africa, also called Mozambique. The island of St. Thomas, almost on the Equator in the Gulf of Guinea, belongs to Portugal. Spain has small territories of little value in Rio de Oro south of Morocco, and Rio Muni on the west coast just



north of the Equator, and in the Gulf of Guinea possesses the island of Fernando Po.

*Distribution of Population.*—The native population of Africa is nowhere very dense except in Egypt, parts of the western Sudan, and a few territories in the south. Only about one-thirty-third part of Egypt is rendered fertile by the Nile and is fit for habitation, but that part is very densely populated by the agricultural *fellahin*. In some parts of South Africa the opening of mines has greatly affected the distribution of population, as native labourers are brought to them in large numbers, sometimes from great distances. As the native peoples of Africa are otherwise almost entirely agricultural they have few large towns, although there are some in the interior of the western Sudan, where, under favourable conditions for communication and trade, native civilization had reached quite a high standard before the white man penetrated their country.

*Products.*—Since Africa has been penetrated and the natives brought to work under white men's guidance Africa has become a producer of food-stuffs and the raw materials for many industries. It is not, as a whole, a land in which large manufacturing industries are likely to be established, although in South Africa (as in Australia) such industries are growing up and will increase. The plant products of Africa are various and of first-rate importance. As for food grains, those common to southern Europe are grown in the Mediterranean region. Outside this the most wheat is grown in the corresponding region of the south, in the western part of Cape Province. The cultivation of wheat for export might, if it became necessary, be extended, especially in the Anglo-Egyptian Sudan. Maize, which is very widely cultivated, is the principal cereal crop in South Africa between 1,000 and 6,000 ft. above sea-level. Maize cobs are familiar under the name of mealies. Millet is a staple native food generally, and we hear of it as Kaffir corn in South Africa, Guinea corn in West Africa, and *durra* in Egypt and the eastern Sudan. The other principal plant products are cotton, hemp, vegetable oils, cocoa, coffee, tea, sugar, tobacco, rubber, and fruits. Cotton is grown principally in Egypt, and the importance of the Anglo-Egyptian Sudan for the production of cotton is increasing. In the western Sudan it has been grown and manufactured by the natives for a long time. Hemp is a product of the drier parts of

east-central and south-east Africa. Vegetable oils are principally identified with West Africa, where the oil-palm and the ground-nut supply much of the trade. The coco-nut, which is dried as copra for export, fringes the coast and estuaries north of the Tropic of Capricorn as far as the horn of Africa and the Gulf of Guinea. Vegetable oils are largely used in soap-making, and so also is the

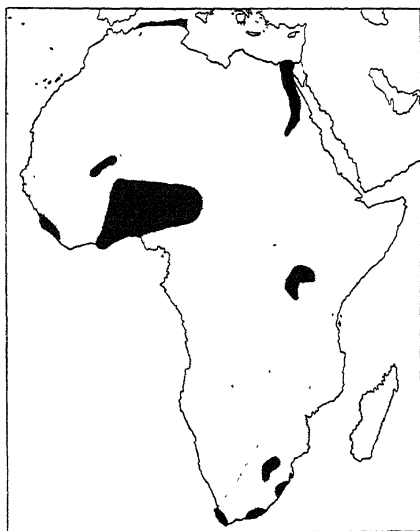


FIG. 85. The parts of Africa where the population is dense (shown in black) and scantiest (in white).

product of the shea nut which grows in the west, where the oil-palm does not, outside the denser forest areas. A vegetable butter is made from it. Cocoa is a west African product identified especially with the Gold Coast and the island of Fernando Po. Coffee is indigenous in Africa and the best comes from south-western Abyssinia. From the district of Kaffa there the plant is said to take its name. Tea is grown mainly in the south-east of Natal, but as its gathering and preparation need much labour it is not very largely cultivated. Both tea and sugar are grown in this region to

a large extent owing to the immigrant Indian population which has settled there. Sugar otherwise is principally grown in Egypt. Rubber is a product of the tropical forests, in which there are several kinds of trees and climbing plants which yield it. Again, because labour is not very easy to get, rubber-yielding trees have not been cultivated in tropical Africa to the same extent as they have in other tropical countries. Tobacco is a product of South Africa, especially the Transvaal, and of Egypt. Among fruits the most important are oranges and grapes of the Mediterranean regions, both north and south, dates which come mainly from the oases in North Africa, and the soft fruits, peaches, apricots, plums, and pears, which are grown to perfection in South Africa and largely exported. It has been said that the African native keeps cattle where he can, but the live-stock industries are not important in Africa except in the south. Sheep are largely reared for wool in Cape Province and Orange Free State in the Union of South Africa, and cattle mainly in Transvaal and Rhodesia and farther north; and here we may compare the Australian distribution, of sheep mainly in Victoria and New South Wales, and of cattle mainly farther north in Queensland. Cattle are also reared in considerable numbers by white settlers in Kenya. But cattle have suffered from serious diseases in the south, and though science has to a large extent overcome these, much of central Africa, from Rhodesia northward to Uganda, is infested with the tsetse fly, which is fatal to cattle and prevents their being bred or used for transport.

The mineral wealth of Africa is great and without doubt there is much still to be developed. Gold is produced principally in Transvaal where the famous field of Witwatersrand is situated, in Southern Rhodesia, and in the Gold Coast territory. South Africa is famous for its diamonds, with the fields of Kimberley in Cape Province and the Premier Mines and others in Transvaal. South Africa is fortunately rich in coal, which has assisted the working of mines and of railways and shipping and is fairly largely exported. There is little coal in North Africa, but a field of some importance has been developed at Udi in Nigeria. Iron is common and is worked by the natives in many parts of Africa, but for export for industrial purposes the mines of Algeria and Tunis are of chief importance. For copper the most important fields are those of Katanga in the south of Belgian

Congo, northern Transvaal, and Damaraland in the arid south-west. Algeria and Tunis yield phosphates ; northern Nigeria has important deposits of tin ; and among other mineral products may be mentioned soda, which is a characteristic product deposited in the waters of shallow lakes in dry regions such as the isthmus of Suez and the Magadi Lake in Kenya ; and platinum, which has been discovered in Sierra Leone.

We must now consider the principal political divisions of Africa in a little more detail.

### MOROCCO

Morocco covers the western extensions of the Atlas Mountains and slopes north to the Mediterranean and west to the Atlantic. Its position, with coast-lines upon both the sea and the ocean, and separated from Europe by the narrow Strait of Gibraltar, is of great political importance. The population, principally of Arabs and Berbers, is nominally governed by a sultan, but some of the inhabitants are unruly and hostile to Europeans. Most of the country is under French protection, but a portion along the coast is protected by Spain ; and the port of Tangier, close to the entrance to the Strait of Gibraltar, is under international control in order that it might not become a centre of power in the hands of any one nation controlling the entrance to the Mediterranean Sea. Morocco has a considerable trade in leather goods (the name of morocco leather being well known), and in silks, rugs, and clothing, including the hat known as the *fez* from the name of the northern capital of the country. It has also trade in dates and in agricultural produce (barley, beans, wheat, linseed) and eggs ; but both these and the mineral wealth would be capable of development if the country were better settled. The French within the territory under their protection are building railways and roads, and some of the ports are developing under European guidance. Such, in addition to Tangier, are Rabat-Sallee, which is the port for Fez, and Casablanca, with extensive harbour works and a considerable European population. Both of these are Atlantic ports. In the interior, Fez is the northern capital of Morocco and Marrakesh the southern.

## ALGERIA AND TUNISIA

In Algeria and Tunisia we find, in the northernmost of the three physical belts into which the country is divided, rich cultivated valleys, under Mediterranean conditions of climate, yielding wheat, barley, olives and olive-oil, grapes, and other Mediterranean fruits. In the steppes farther south there is pasture in spring after the winter rains ; and esparto grass, used for paper-making and other purposes, is gathered and exported. Along the northern fringe of the desert to the south the oases yield large quantities of dates. Tunis, to the east of Algeria, has the advantage of both an eastern and a northern coast. Under French administration both territories have been largely developed by means of railways and good roads. In addition to the products already mentioned there are iron and phosphate mines. Algiers, the capital of Algeria, is the principal port, situated where the rainfall of the Mediterranean coast of Africa is most plentiful and the surrounding territory most fertile. Tunis, the capital of Tunisia, is situated near the north-east angle of the coast at the point where the main channel of the Mediterranean is narrowed between Cape Blanco and Sicily. It is for this reason an important trading centre, as ancient Carthage, the site of which is close to it, was in classical times and earlier.

## FRENCH WEST AFRICA

The territory of Algeria merges in the south into French West Africa, which includes the western Sahara and is divided into seven separate colonies, with a chief centre of administration at Dakar on the western coast, in Senegal. This has a fine harbour which has been developed by the French, and there is railway communication with the interior. The coastal possessions trade in ground-nuts, timber, palm-oil, coco-nuts, and rubber. These possessions include the Ivory Coast, which takes its name from the elephants which yielded ivory in the early days of trading with these countries, but are now extinct. The interior of the French Sudan has areas suitable for agricultural and pastoral development where the country is not too dry. The most famous inland city is that of Timbuctoo, close to the river Niger where it reaches its most northerly point and borders the desert on the north. The river forms the line of com-

munication to Timbuctoo both from south-west and from south-east, and the city was therefore the starting-point for caravans across the desert to the north, but this traffic is declining, as the modern routes for trade are mainly westward to Dakar or southward to the Guinea Coast. The French, however, have used both aeroplanes and specially fitted motor-cars to cross the desert.

#### EGYPT AND THE ANGLO-EGYPTIAN SUDAN

*Egypt* is now a kingdom as it was in very early history, though until recently, after being under Turkish rule, it was under British administration. We have found that the settled part of Egypt consists of a narrow strip, sometimes little over a mile wide, on either side of the river Nile where cultivation is possible, as it is also in the delta of the Nile and in the oases of Faiyum which lies to the west of the river and south of the delta. The agricultural portion of Egypt is irrigated by a system of canals from the river. Some of them are supplied from the permanent flow of the Nile, as in Faiyum and the delta, but the rest of the country depends for its irrigation upon the seasonal flood-waters which are distributed over it by means of shallow channels. Great works have been carried out for irrigating the land and preserving the flood-waters by means of dams, of which the most famous is that at Assuan. The water held up above the dam can be allowed to flow regularly through sluice-gates instead of running too high at the flood season and being, as it used to be, in large part wasted. The great modern irrigation works are principally British, and it is largely due to these that Egypt has been able to maintain a growing population and develop a trade in cotton, maize, millet, oil-seeds, and many other agricultural products. The capital of Egypt is Cairo, near the head of the delta, a natural situation for a town, where the river lines of communication branch out from the delta, and east and west lines cut first across the river as a single stream above its mouths. The principal port is Alexandria, situated on the western side of the delta where the sea is less liable to be silted up by the muddy deposit of the river.

*The Suez Canal.*—On the eastern side of the delta is Port Said, at the Mediterranean end of the Suez Canal, which connects the Mediterranean with the Red Sea. Opposite (on the side toward Asia) is the new Port Fuad, which may replace Kantara (midway on the

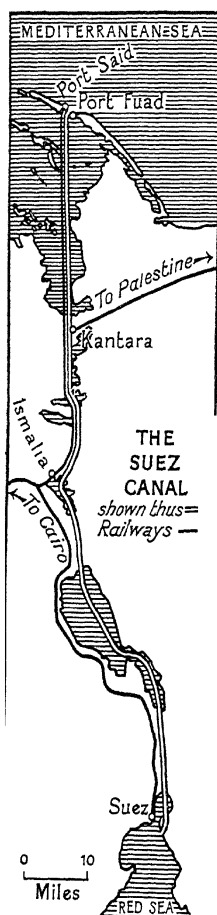


FIG. 86.

canal) as terminus of the railway from Syria. The existence of the Suez Canal accounts largely for the interest of Britain in Egypt, as the canal is mainly under British control and forms a line of communication of first-rate importance between Britain and India, Australia, and the Far East. The cutting of this canal saved ships sailing between Europe and these countries from having to round the Cape of Good Hope or Cape Horn, and although the Panama Canal has slightly reduced the distance between western Europe and Britain and the southern Pacific, it does not greatly affect the immense traffic passing through the Suez. Great ships are moving constantly through this straight channel cut and embanked through the desert sands, and unhampered by any locks as it runs a hundred miles from sea to sea without change of level.

*The Anglo-Egyptian Sudan* to the south of Egypt is under the joint administration of Egypt and Britain. Communication with it from Egypt is supplied not only by the Nile but by the railway which runs alongside the Nile as far as Shellal near Assuan. South of this point there is no railway as far as Wadi Halfa. South again a railway runs across the Nubian Desert, cutting off a deep bend of the Nile in which there are two more cataracts, and continues

by the river to Khartum, the capital of the Anglo-Egyptian Sudan, which is situated at a natural point for an important town where the Blue and the White Niles join to form the main river. There is a branch of the railway to Port Sudan on the Red Sea, and the line

is continued for a considerable distance south of Khartum. The northern part of the Anglo-Egyptian Sudan is desert, but the middle part has a small rainfall representing the northernmost extension of the monsoon rains of east Africa. This region, however, is capable of irrigation, and large works are in progress for watering lands along the river without making the supply for Egypt too small. The area between the Blue and White Niles consists of open country sloping gently from east to west; it is very fertile; and without doubt the country could support a larger population than it does, and could be made capable of more extensive production, as for example of cotton and wheat. On the White Nile there are swamps, and the river is apt to become blocked with the floating masses of vegetation called sudd, but toward the south in the valleys of the Sobat, the Upper Nile, and the Bahr el-Ghazal there are wide areas covered with good pasture.

#### CENTRAL AFRICA

*French Equatorial Africa.*—In west-central Africa the territory known as French Equatorial Africa borders parts of the lower Congo and its great northern tributary the Ubangi, and includes a strip on the west coast south of the Gulf of Guinea. As a tropical territory it is known to be of value for various products, but it has been difficult to develop owing to the difficulty of communications between the coast and the interior, as there is no great river giving direct access to it.

*Belgian Congo.*—The case of the Belgian Congo is different. This territory may be likened to a wide bottle with a narrow neck opening upon the coast at the mouth of the Congo. As we have seen, the main river leads, in a wide curve, into the very heart of Africa, and receives many tributaries on both banks, so that there are thousands of miles of navigable waterways within the territory. The main river itself offers an interesting example of the development of a territory mainly by means of a natural waterway, but with the help of railways where navigation is impossible. The mouth of the river is navigable by ocean-going ships for no great distance, but on the estuary the capital of the territory, Boma, is situated. Not far above this point the river descends from the interior plateau through a cleft in the fringing hills in tremendous rapids and falls, and a railway passes around these to the upper river. Thence there are nearly



a thousand miles of navigation until the next rapids are reached, and a railway of some eighty miles has been built around these. Another 300 miles of navigation follow, and then again a short railway passing rapids and giving access to the navigation on the upper Lualaba, the head-stream of the Congo. There is also a railway to the western shore of Lake Tanganyika. Belgian Congo, for such products as palm-oil, rubber, and cocoa, would be one of the richest tropical regions in the world if fully developed. Moreover, in the south-east it includes the rich mineral region of Katanga, which has already been largely developed with the help of railway communication from the British territory to the south, and by using Beira in Portuguese East Africa as its port. This is far distant, and a railway is built to the boundary of Angola (Portuguese West Africa) from Lobito Bay, a west-coast port in that territory with a good natural harbour. This railway will better serve the Katanga mining district.

#### EAST AFRICA

*Kenya and Tanganyika.*—From Kenya to the Cape of Good Hope the British Empire in Africa includes most of the regions which are suitable for white people to settle in, excepting those bordering the Mediterranean Sea. In Kenya the Europeans live mostly near the Uganda railway and its branches, and at elevations from 5,500 to 9,000 ft. The distribution and character of the population differ as much as the surface of the country. Arabs live mainly on the low hot coast, and there are many Indians here also, but these appear in most parts of the country as traders. In the dry north-east the natives are few and nomadic. The closest native population is found around Lake Victoria. From the north-west side of this lake the protectorate of Uganda slopes northward down the upper basin of the Nile to the Sudan frontier. Much of this district also has a large native population, but parts of it have been subject to the terrible sleeping sickness, and the natives, in order to avoid this, have had to be moved entirely from some districts, including islands in the lake. The capital of Kenya, Nairobi, is on the high plateau, and the only important outlet for trade is the port of Mombasa. The Uganda railway runs from this port to Nairobi, to the port of Kisumu on Lake Victoria, and to the river Nile in Uganda. The colony, in accordance with this diversity of elevation and climate, yields many different

products. Among the chief of those exported are coffee, maize, hemp, soda, hides and skins; the coffee and maize from the well-watered slopes; hemp from the drier lands; soda from the lakes of the dry region; hides and skins from the cattle kept on the pastures of the high plateau. Among other products are wool, ground-nuts, ivory from the elephants in the forests, copra from the coco-nut palms of the coast; and there are good possibilities of developing the cultivation of sugar and tea. Tanganyika territory is in large part very thinly populated, but there are highland areas in the north-east bordering Kenya and in the south-west toward Lake Tanganyika and Nyasa which are fit for European settlement. The products are similar to those of Kenya, with sisal hemp as the chief, coming from the dry zone behind the coast. There is promise for gold and tin mining. The chief port is Dar es-Salaam, from which a railway runs westward to Kigoma on Lake Tanganyika.

*Nyasaland and Rhodesia.*—To the south-west of Tanganyika territory is the Nyasaland Protectorate, bordering Lake Nyasa on the west, and Northern Rhodesia lies to the west of this. Europeans have settled mainly in the Shire Highlands in Nyasaland and along the railway which runs from Cape Town to the upper Congo and passes through the centre of Northern Rhodesia. Traders are waiting better railway communication, especially with the east coast, for the export of their products. Nyasaland has a railway southward to the Zambezi, but there a ferry must be used to connect with the railway from the south bank to the port of Beira in Portuguese East Africa. Northern Rhodesia sends its products for export overseas also to Beira, but by a very long railway route. There is, however, a market for Northern Rhodesian products in the Katanga mining district of Belgian Congo. There is land for ranching, and some cotton is grown, while the development of copper, lead, and zinc mines is beginning. In some parts the cattle are attacked by the tsetse fly and are subject to diseases. Southern Rhodesia is also a savanna land where cattle-rearing is important, and such fruits as oranges and lemons can be grown, ripening in the dry season, which is winter. Tobacco is important. The territory is rich in minerals, especially gold and coal. The chief town is Bulawayo at the junction of the main railway from the Cape, with a branch to Beira, which again is the principal port for export.

## SOUTH AFRICA

*The Union of South Africa* consists of the four provinces of the Transvaal, the Orange Free State, Natal, and the Cape of Good Hope. It also administers South-west Africa. Within the area of British South Africa are other territories—Swaziland, Basutoland, and the Bechuanaland Protectorate—which are mainly in the occupation of native peoples. We can compare South Africa in some respects with Australia, but so far as concerns population the marked difference is that in South Africa, as elsewhere in African territories where Europeans can settle, there is a fairly large native population on which the development of agricultural and mining industries depends for labour. There is something less than four times as many natives as white people. The native population is not everywhere very numerous, and it is not everywhere easy to get sufficient labour, but the population generally is increasing and the British administrations see to its careful treatment in the way of education and health. In South Africa there are two main divisions of the white population, the British and the Boers. The Boers are descendants of the Dutch who first opened up the country. They are principally engaged in agriculture and pasture and are settled chiefly in the interior, in country districts and small towns. Their presence accounts for many place-names and geographical terms of Dutch origin.

*The Transvaal* is the territory 'across the Vaal' river as it was approached from the south by the first white settlers. It covers part of the high plateau or High Veld and slopes from this toward the low or Bush Veld. Between these lies the Middle Veld, the surface of which is broken by ridges, called rands. From one of these, the Witwatersrand, great quantities of gold are mined, and the town of Johannesburg is the chief centre. The slopes of the plateau have fine agricultural lands where maize, wheat, tobacco, and other crops are grown, and in this region is Pretoria, the administrative centre of the Union. The low veld is unhealthy for white settlers. The nearest seaport which forms the outlet for the trade of Transvaal is Lourenço Marques, and the railway from Pretoria to this port passes through the rich coalfield of Middelburg. Lourenço Marques is in Portuguese East Africa, and through this port and that of Beira

already mentioned passes much trade which comes from British territories. But for this Portuguese East Africa would be a poorer country than it is, for although the Portuguese have long had settlements along its coast there are few points at which the interior has been opened up. The coastal lowland is here wetter than elsewhere in South Africa and much of the country is difficult and unhealthy.

*The Orange Free State and Natal.*—The Orange Free State to the south of Transvaal belongs to the High Veld and is largely pastoral country. The capital is Bloemfontein, in the centre of the territory, and it has communications with the Natal port of Durban and other ports farther south. Natal to the east of the Free State slopes from the highlands of the Drakensberg, which form the edge of the high plateau, through a hilly agricultural belt to the narrow warm coastal lowland. The highland area is largely pastoral, as elsewhere. The upper slopes also pasture cattle and sheep. Maize, wheat, millet, and tobacco are grown, and there is a large cultivation of wattles, the bark of which is of value in tanning the hides yielded by the cattle, while the trunks are sent for pit-props to the gold mines of the interior. There is a coalfield in the neighbourhood of Dundee. The capital is Pietermaritzburg on the middle slopes behind the principal port of Durban, which has grown up upon a landlocked harbour to become the chief town in the province. Coal, wool, hides, sugar, gold, and many other products from Natal and from the interior are exported from Durban.

*Cape Province.*—The Province of the Cape of Good Hope, or more shortly Cape Province, is, as we have seen, a region with Mediterranean conditions of climate in the south-west, where the capital, Cape Town, is situated. In the south-east, adjoining Natal, there is a continuation of the conditions in that province. Behind these coastal belts the terraces known as the Great and Little Karroo lead like huge steps to the High Veld of the interior. Towards the north-west of the province the country merges into the dry region of South-west Africa, where the best land is fit for pasture, but there is much that is desert or nearly so. The Cape Province exports large quantities of wool, hides and skins, and ostrich feathers. These are products of the pastures on the High Veld or of the ostrich farms of the Karroo. The Mediterranean region grows fruits, and wine is made from the grapes. The south-east grows maize and

tobacco. The richest export is that of diamonds, for which the principal centre is Kimberley. The capital, Cape Town, is the chief port of South Africa and grew up on a natural harbour somewhat exposed to the west and protected now by a breakwater, but sheltered on the south-east by the noble height of Table Mountain. Other ports in the south-east of the province are Port Elizabeth and East London.

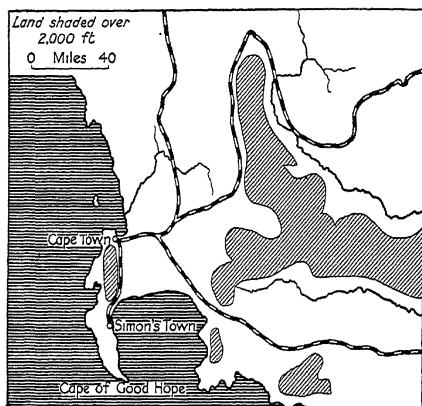


FIG. 87. THE POSITION OF CAPE TOWN. The difficulty of the ascent to the South African plateau is suggested by the long detour made by the railway in the centre, around the area shown to exceed 2,000 ft. above sea-level.

*Communications.*—The Union of South Africa, so far as concerns the richer territories, is fairly well provided with railways. A trunk line runs from Cape Town to the upper waters of the Congo at Bukama, crossing the Zambezi close to the splendid Victoria Falls. This line is sometimes known as ‘the Cape-to-Cairo railway’, because if such a railway were completed, as has been thought of for many years, this would form a principal part of it. We have seen that in the north through Egypt there is no railway south of Shellal, but that navigation is possible above that point as far as the border of the Anglo-Egyptian Sudan. Through that territory there is railway communication for a long distance, but beyond that, in order to make the journey from Cairo to the Cape, the Nile must again be followed until from Lake Albert the watershed between its basin and

that of the Congo must be crossed. Here a railway is projected. The Congo may then be followed, except, as we have seen, where rapids are passed by short railways, as far as Bukama. Such a railway, if completed from the north-east to the south of the continent, would have advantage in itself as a through route, but would be even more valuable as a communication between lines crossing the continent east and west. All the British territories from Southern Rhodesia northward await the extension of the railway, to the east coast ports especially, before they can be developed much more fully than they are. Apart from railways, there are various means of travel typical of different parts of Africa, of which we may read in many travel narratives. There are the oxen harnessed to wagons of which we hear in South Africa ; there are the native porters who, in the tropical parts especially, carry great loads on their heads and also bear white men in hammocks slung from bamboo poles ; there are the caravans of camels which cross the desert of the Sahara and are used also in some of the drier regions of the south. The Saharan camel routes have become less important in recent times owing to the development of railway traffic toward the nearest coasts in the Sudan, but still there are important caravan lines from the south to Tripoli and the oases bordering the desert edge of the Atlas Mountains. Some of the African rivers and lakes are of first-rate importance for transport. The Nile and the Congo have already been mentioned. The Zambezi and the Niger have been of less importance in opening up the territories through which they pass. The great lakes of East Africa carry a considerable steamship traffic.

#### ISLANDS IN THE ATLANTIC AND INDIAN OCEANS

In this section we are to notice a few islands or groups of islands, mostly to be classed as 'oceanic', being distant from any mainland, though, with two exceptions, nearer to Africa than to other continents.

*Atlantic Ocean.*—The Azores, due west of Lisbon, Madeira, west of Morocco, and the Cape Verde Islands, west of Cape Verde, belong to Portugal ; the Canary Islands off the Spanish African coast of Rio de Oro (south of Madeira) belong to Spain. They are largely volcanic in origin, and fertile. The Azores and Madeira yield fruits and crops of the Mediterranean type ; so also do the Canary Islands,

though they are drier, not coming within reach of the westerly winds in winter. It may be noticed that camels are used freely for transport in the Canaries. Madeira and the Canaries, lying on or near the tracks of steamers bound from Britain and western Europe to eastern South America and South Africa (see Part II, p. 505) offer convenient ports of call; and beauties of scenery and attractions of climate, especially in winter, bring them many European visitors. The Cape Verde Islands are drier than the Canary Islands, but still, thanks to the influence of the ocean, they have sufficient moisture for the cultivation of coffee, maize, and fruits, and cattle are reared.

Far away in the South Atlantic Ocean, the little British island-colony of St. Helena lies 1,200 miles from the nearest point of the African coast, and 700 miles from Ascension Island, which is included in the colony. These islands were of value as ports of call before the Suez Canal was opened, when ships could only sail to Asia and Australia by the southern ocean. St. Helena has industries in growing flax and in lace-making; Ascension yields guano, and turtles are taken in large numbers. Still more remote is the island of Tristan da Cunha, a dead volcano rising 8,000 ft. from the sea, whereon a narrow plateau supports something over 100 people. Lonely as they are—for ships seldom visit them—they do not wish to leave. They cultivate potatoes and fruit trees, rear a little live stock, and find the means to live simply, and without a government such as St. Helena has as a colony. They provide a remarkable example of the effects of what is called geographical environment—the ‘environment’ consisting, in this case, of a scrap of land standing alone in a vast expanse of ocean, far from any of the routes by which men most frequently sail the seas.

*Indian Ocean.*—In the Indian Ocean, the big island of Madagascar, over a thousand miles long and up to 350 miles wide, belongs to France. It is of plateau form something like that of East Africa, and has its highest points toward the east, and its steepest slopes to the east coast. Here the south-east trade winds, from over the ocean, bring rain at all seasons; in the west the rainfall, like that of the east African coast-lands, is more distinctly in summer. The low-lands are thickly forested except in the south-west; here, and on the higher ground generally, is savanna land. The island is fairly populous as compared with the African mainland, but many of the

native tribes are remote and not easily approached ; there are, on the other hand, some thousands of immigrant traders and cultivators from Asia—Indian, Arabs, and Chinese. Many minerals are known, and gold-working is of some importance ; other products are rice, cattle and hides, and forest products such as rubber, waxes, and gums.

Mayotte, the Comoro Islands, and Réunion, small oceanic islands belonging to France, produce vanilla and sugar. Sugar also is by far the most important cultivation in Mauritius, a British island in which the immigrant Indian population outnumbers the rest. The Seychelles Islands yield coco-nuts, cinnamon, and phosphates, and a naval coaling-station is situated here. Among other British islands, Diego Garcia may be mentioned, a coral atoll, the chief of the Oil Islands, named from their export of coco-nut oil.

### EXERCISES

1. Describe the natural features and scenery of (a) any part of the Sahara desert ; (b) the Congo Basin ; (c) the veld.

2. Divide Africa either north or south of the Equator into natural regions. Describe in detail the features of any one of these regions, and give the positions of similar areas in other parts of the world.

3. Until the journeys of Livingstone and Stanley, little was known of the interior of the continent ; because of this, it was called the ' Dark Continent '. Give reasons to account for this, and show how relief and climate have hindered the development of certain parts of Africa.

4. Why do the Atlas region and Cape Town get winter rainfall only ? Describe the physical features and products of the first named.

5. Give detailed descriptions of the following : (a) an oasis ; (b) a desert caravan ; (c) a storm in the desert.

6. Describe the course of one of the following rivers : Congo, Niger, Zambezi. To what extent are these rivers navigable, and what use is made of them ?

7. Draw a map of the Nile basin. Show the width of the valley by shading the high ground. Mark the cataracts, dams, and chief towns, and draw the railways. Add a note to explain how the summer floods are caused.

8. ' The Nile is Egypt, and Egypt is the Nile.' Write an essay on this subject.

9. Draw a map to show the so-called ' Cape-to-Cairo railway '.



Show the finished portions and the junctions of other lines running from east and west coastal towns. Mark the towns on the railway. What are the chief difficulties in the way of its completion ?

10. Give the distribution of the following peoples in Africa : (a) the Zulus ; (b) the Pygmies ; (c) the Bushmen.

11. Describe the physical features, climate, and products of any of the following countries : Rhodesia, Kenya, Nigeria, Portuguese East Africa.

12. Draw a map to show the British possessions in Africa. Write notes on the conditions for and against their settlement by white people.

13. What districts produce coffee, cotton, tobacco, rubber, wheat ?

14. What is a rift valley ? Describe those in Africa. Draw a west-east section to show the rift valley lakes and plateau of East Africa.

15. Give an account of the rainfall of South Africa and show how the distribution affects the vegetation.

16. Describe the main physical features of the South African plateau and draw a section to show the plateau, mountains, and coastal plain.

17. Describe the mineral wealth of South Africa, and name the districts and towns connected with mining industries.

18. Draw a map to show the railway communications between the ports and interior of South Africa. What trade passes through these ports ?

19. Name the agricultural products of the Nile basin, and describe the conditions under which they are grown.

## VIII. NORTH AMERICA

*The New World.*—The two Americas, north and south, are known as the New World because they did not become well known to Europeans until the sixteenth century. The two continents are joined by the narrow belt of land called Central America, narrowest at the isthmus of Panama, which measures little over 30 miles across at its narrowest point. The Americas thus have the longest extension north and south of any land-mass ; but their area is only about half that of the Old World, that of North America being 9,000,000, and that of South America 7,000,000 sq. miles.

*Outline.*—In learning the map of the two Americas together, an important point to remember is that most of North America lies west of most of South America. If the eye be carried southward from the east coast of North America, it comes, not to the east coast of South America, but to the west. We will further consider this point, and the comparison of the two continents, when we come to South America. As for the map of North America, its central meridian is  $100^{\circ}$  W., and the main points of the outline and relief are very simple. In the north the mainland coast extends to the Arctic region, the western half lying roughly along the parallel of  $70^{\circ}$  N. This coast continues the Arctic coast of Asia, from which it is separated by the narrow Bering Strait, which connects the Pacific Ocean with the Arctic. In the eastern half there is the deep inlet of Hudson Bay ; but to the north of this coast there is an archipelago of big islands extending nearly to the north of Greenland, the nearest land (so far as we know) to the North Pole. The continent has roughly the shape of a triangle. The north-west angle is in  $70^{\circ}$  N. ; this is in the territory of Alaska. The north-east angle is in the territory of Labrador ; this is nearly as far south as  $50^{\circ}$  N. That parallel is a useful line for the map. On the eastern, the Atlantic, coast it locates the island of Newfoundland, which lies across the Gulf of St. Lawrence, the entry to the river St. Lawrence, one of the chief waterways to the interior. The head of Hudson Bay is nearly in the same latitude. On the western, the Pacific, coast this line nearly marks an abrupt change in outline. To the north the coast is broken by deep fiords and fringed with many islands, large

and small ; to the south it is almost unbroken, and there are no large islands and almost no small ones. The parallel of  $30^{\circ}$  N. roughly marks the heads of two deep gulfs : on the Pacific side the Gulf of California, narrow, and separated from the ocean by the peninsula of Lower California ; on the Atlantic side the Gulf of Mexico, wide, and separated from the ocean by the peninsula of Florida and islands

of the West Indies. South of  $30^{\circ}$  N. the continent narrows to its southern apex, in Mexico about  $15^{\circ}$  N., and its junction with Central America.

*Relief.*—The plan of the continental relief is simple : (1) eastern highlands, fringed, in their southern part, by a low Atlantic coastal belt ; (2) central plains, level to the eye, but sloping gradually upward to the west till they reach the foot of (3) the western mountain belt, which extends to the Pacific coast.

*The Laurentian Highlands.*

—The eastern highlands are divided into two parts : the Laurentian highlands north

of the St. Lawrence river, and the Appalachian highlands south of it. The Laurentian highlands form part of an area of very old rock (archaean, from a Greek word meaning 'old') which, as a land surface, encircles Hudson Bay. The greater part of this area, however, is not highland. You may trace on the map a series of big lakes, from Great Bear lake in the north-west, through Great Slave, Athabaska, Reindeer, and Winnipeg to the five so-called Great Lakes of North America, from which the river St. Lawrence flows to the Atlantic. A line through these lakes, and along the St. Lawrence, gives us roughly the boundary of the archæan region ; the Archæan Shield or Canadian Shield as it is sometimes called from its outline and low relief.

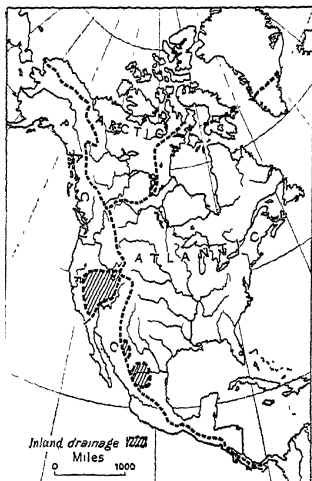


FIG. 88. OCEANIC DRAINAGE AREAS OF NORTH AMERICA.

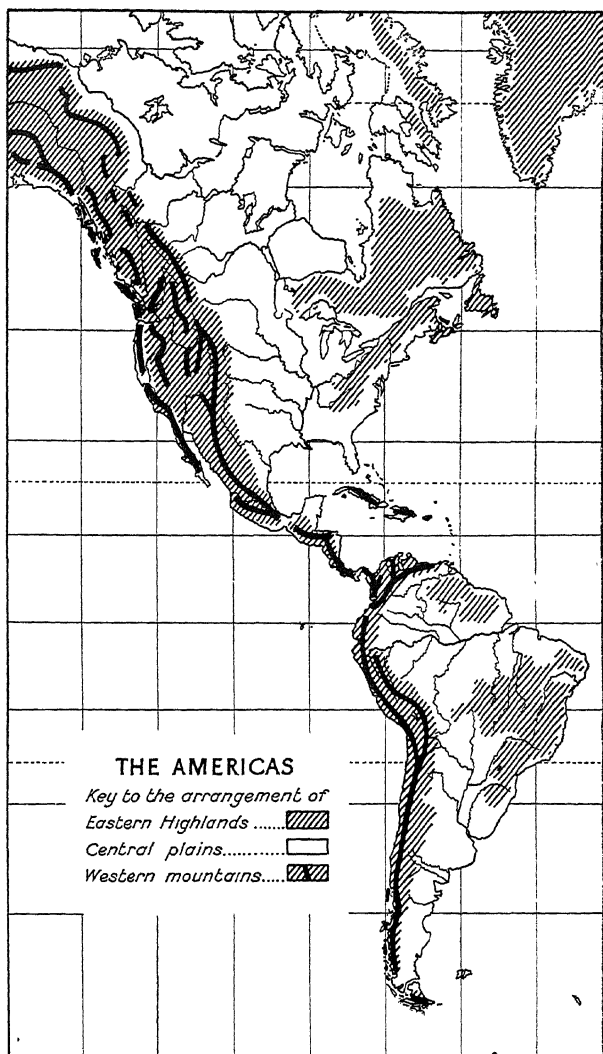


FIG. 89.

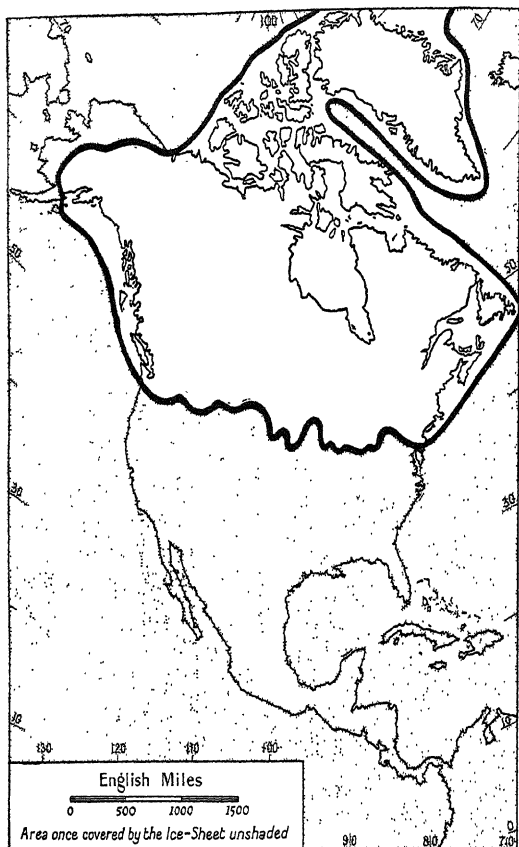


FIG. 90. THE GLACIATED AREA OF NORTH AMERICA.

Ancient as it is, its present surface features were formed in great part at a comparatively recent period in geological time. For during the glacial period ice-sheets spread afar from the Laurentian high-lands or from Greenland as a centre, wore down the surface, and carried soil away from it, leaving much of it, as it still is, bare and

rocky, scattered with ice-borne rocks and gravels, and worn into ridges and hollows. In these hollows lie innumerable lakes, large and small. The formation of the small lakes may be accounted for by glacial action such as the erosion of hollows and the damming of valleys by drift; but further reason for the existence of the larger lakes must probably be looked for in warping and sinking of parts of the earth's crust, resulting in basins in which the lakes have been formed. Many of the rivers flow, it might almost be said, casually, dropping over ledges in falls and cataracts; and often no well-marked watershed can be traced between their sources. Only in the north-east, in Labrador, do the highlands become mountains of 8,000 ft. or more; and the Labrador coast is steep, rocky, and indented with fiords. The Archaean Shield may be compared with Scandinavia and Finland in the Old World, a region which (sometimes called the Baltic Shield) also has its belts of sunken tracts filled by large lakes—Onega, Ladoga—and small, as well as by the Baltic Sea and its gulfs.

*The St. Lawrence*, which separates the Laurentian highlands from the Appalachian, is one of the noblest of the world's great rivers. It leads, a highway for ocean steamers, inland 650 miles from the open sea to the city of Montreal: above this there are rapids, down which smaller steamers may run (an exciting journey); but they must use canals and lakes going up. Above the rapids a beautiful reach leads through the so-called Thousand Isles to the lowest of the Great Lakes of North America, Ontario. The others, following them upward, are Erie, Huron, Michigan, and Superior. They are

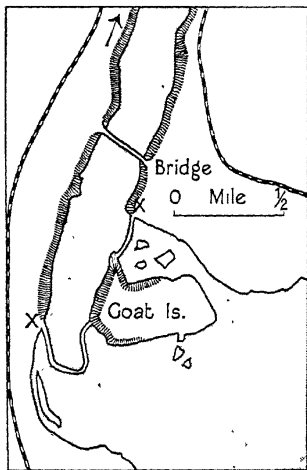


FIG. 91: NIAGARA FALLS. The falls extend between the points x-x, the two being separated by Goat Island. The Canadian fall is the southern. The scale is the same as that of Fig. 79, which shows the Victoria Falls of the Zambezi in comparison with the Thames at London Bridge.

inland seas of fresh water, over 90,000 sq. miles in area together ; and that is more than the whole of Great Britain. There is a fall of

330 ft. between Erie and Ontario. The short Niagara river, between these lakes, forms the famous Niagara Falls, and tremendous rapids in the gorge below them. Between Erie and the other lakes there are no great differences of level. Rivers, canals, and the lakes give a waterway of 1,200 miles from Montreal to the head of Lake Superior, and about the same to the head of Lake Michigan.

*The Appalachian Mountain System* extends from the island of Newfoundland (which is really a separated part of it) 1,500 miles south-westward until it sinks to the lowland bordering the Gulf of Mexico. This great division of the eastern highlands is nowhere very high—no summit reaches 7,000 ft.—and it is broken by many valleys of rivers which cut across the axis of the system and flow eastward or westward, as well as by a longitudinal series of valleys, known together as the Great Appalachian valley. The highlands are generally of gentle outline, not rugged. But with their steep forested slopes, indirect valley-routes and great breadth they were for long a

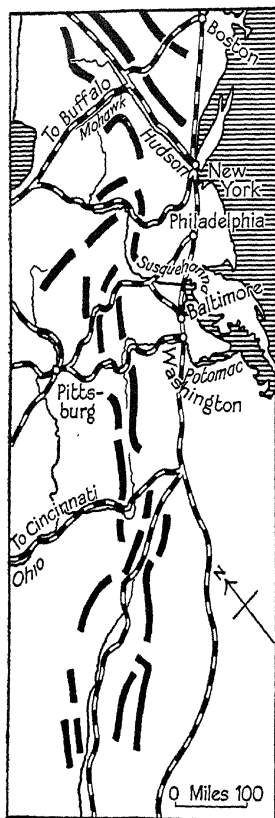


FIG. 92. Diagram of main ridges and valleys in the Appalachian region, and relation thereto of main railway routes.

barrier to the penetration of the interior of North America by the British and others who settled on the Atlantic coast in early times—much as the eastern highlands of Australia long hindered

exploration from the coast. And the valleys across the Appalachian system afford, for the most part, rather difficult railway routes ; but there is one which, with a branch of it, is easy and of immense importance : this is the Hudson valley, which leads north from the east coast about  $40^{\circ}$  N. to the St. Lawrence valley, with its branch the Mohawk valley leading, about midway, westward to the Great Lakes. We shall notice later the relation of these valleys to the

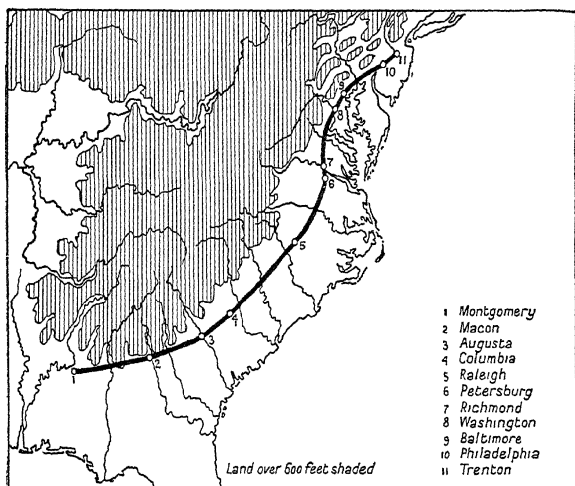


FIG. 93. THE FALL LINE AND CITIES SITUATED THEREON.

position of New York and other famous cities. The southern part of the Appalachian mountain system is bounded by a plateau on the east and on the west. That on the east is commonly called the piedmont (foot of the mountains) plateau, and it slopes to the Atlantic coastal lowland. Its rocks are hard ; those of the lowland softer ; and where the east-flowing rivers pass from plateau to lowland they form falls over the edge of the harder rocks. The ' Fall Line ' which may be drawn on a map through all these falls, and therefore along the plateau-edge, is found to pass through a town at each fall, where the water-power is used in factories.

*The Atlantic Coast* of the northern Appalachian region is rocky



and rugged. The Bay of Fundy, between the peninsula of Nova Scotia and the mainland, is long and narrow, so that the tidal waves, passing up it, are so constricted that the water-level at the head of the bay may be over 60 ft. higher at high tide than at low. Where the

St. John river enters St. John harbour over a rocky ridge, a fall of several feet is sometimes caused, as the tide falls, from the river to the harbour; and, what is more strange, a fall upstream from harbour to river as the tide rises.

On the map about  $42^{\circ}$  N. a cape, curiously shaped like a sickle, by name Cape Cod, will be seen. It is built up of sea-borne sand; and most of the Atlantic coast to the south is fringed with sand-banks built up by the waves, and lagoons behind them. The coast-lands, as we have seen, are low, and the sea has drowned many of the lower valleys of the rivers and penetrates up them far into the land.<sup>1</sup> The Appalachians sink in the south to low rolling country at and west of the base of the Florida peninsula. This peninsula, for the rest, is low, made largely of limestone and containing many lakes formed by solution of that rock; there is a good deal of swamp, especially in the south, where a strange tract



FIG. 94. A part of the low Atlantic seaboard of U.S.A., fringed with sand-banks enclosing lagoons, and indented with estuaries and creeks. Shallow lakes and marshes also are typical.

of shallow water and soft islands, thickly grown with vegetation, is known as the Everglades. Florida extends southward into waters warm enough for coral to flourish along the coast.

The plateau bordering this southern Appalachian system on the west is the Allegheny plateau. It sinks to the central plains of the continent.

<sup>1</sup> See Part II, p. 460.

*The Central Plains* of the continent extend from the Arctic coast to that of the Gulf of Mexico, and about their centre are 1,500 miles wide. Along certain lines they rise westward by fairly well-marked terraces, and in some parts they are broken by hills, or deeply eroded with steep-sided valleys; but for the most part they look level to the eye, and monotonous. In the central part of the plains the rich soils of glacial drift are found as far south as lat. 40° N. or even farther. Westward from Lake Superior to the western mountains the plains are hardly anywhere below a height of 1,000 ft. above sea-level, and in this part are found watersheds between river-basins draining north, east, and south.

*The Mississippi.*—The great river of the southern plains is the Mississippi. Its name is taken from American Indian words meaning the 'father of waters', and is well chosen. The river drains a basin of  $1\frac{1}{4}$  million sq. miles, gathering waters not only from the plains but from the western slopes of the eastern highlands, and the eastern slopes of the western mountains. Its chief eastern tributary is the Ohio, its chief western tributary the Missouri. The source of the Missouri is actually the head-stream most distant from the mouth of the Mississippi; the distance is 4,220 miles. The river and its

tributaries give 15,000 miles of navigation. The work of the river as it flows over the plains in its lower course is typical (that of the Hwang-ho in China may be compared). When it reaches the nearly level part of its bed its speed is lessened, and much of the sediment which it carries settles down. This happens principally along the sides of the river where the speed is least, and the banks, and even

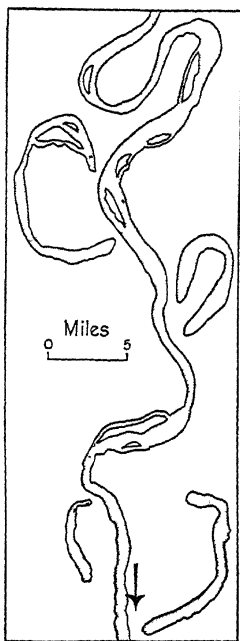


FIG. 95. A part of the middle course of the Mississippi, showing meanders and cut-offs. It is on the same scale as Fig. 77, in which a part of the middle Congo is compared with the Thames at London.

the whole bed of the river, are raised above the level of the plain. If by flood the banks are broken, the waters spread far over the plain. This has sometimes happened, and great damage has been caused, in spite of much labour spent in taking care of, and where necessary raising, the banks. These are here called levees, from the French *lever*, to raise; for the first work on the river was done by Frenchmen. The river winds across the plain, eroding its banks at the bends and building them up with deposited sediment on the points. In this process two eroded bends may be brought closer and closer until the river breaks a straight passage between them. The ends of the bend thus cut off are blocked by sediment, and the old channel remains as a crescent-shaped lake, called a cut-off. The lowest flood-plain of the Mississippi, from the junction of the Ohio to the Gulf of Mexico, is 600 miles long, but the course of the river through it is nearly double that. The flood-plain is from 25 to 80 miles wide, and bounded (in part) by clay bluffs up to 300 ft. high. Besides the main river, branch channels wander through it: they are commonly known as bayous (another word of French origin). The Mississippi enters the Gulf through a delta, for the currents of the gulf are not strong enough to carry away all the sediment brought down by the river; we may notice the curious finger-shaped banks which the main stream and distributaries have built seaward.

*The Western Mountain Region* of North America extends through the length of the continent, and where it is widest, about lat.  $40^{\circ}$  N., it is about one-third of the width of the continent. The whole mountain system is sometimes called the Rocky Mountains (or, for short, the Rockies), but this is properly the general name for the eastern-most main ranges only. The region consists of a series of basins, plateaus, and longitudinal valleys enclosed between the Rocky Mountain ranges in the east, the coast ranges in the west, and other ranges between them. The term *cordilleras* also is applied to the whole system. A cordillera is a mountain range belonging to a system of parallel ranges, and the western mountain system of North America consists, broadly speaking, of parallel ranges along the length of the continent. The term is Spanish, and is borrowed from the Andes, the western mountain-system of South America (where the Spanish language is used). And among the comparisons

which may be made between North and South America (p. 338), the likeness first to be noticed is that in both continents there is a western mountain system. The two systems might be considered as one, connected through the isthmus which connects the two continents; but actually they are not: the North American mountain system ends southward in Mexico; the South American



FIG. 96. The remarkable structure of the Mississippi delta, which does not take the 'original'  $\Delta$  form. The main stream and its distributaries have built out low banks and fingers of soft land. Some of the distributaries rise at the foot of the raised banks of the main stream, gathering waters which filter through them.

system northward beyond the southern end of the isthmus. The mighty folds and faulting of the earth's crust which have upraised both systems run, generally speaking, north and south. The isthmus belongs to a system of folds which run more nearly east and west, and include much of the archipelago of the West Indies, and submarine ridges between those islands.

The folding of the western mountain system has continued through vast periods of time down to late ages; because it has so continued, the mountains rise bold and high, and are far grander to view than the eastern highlands where the folding is old, and

the smoothing by erosion has been carried farther. The lines of folding may be traced on a physical map. From the north of the Pacific coast to near  $50^{\circ}$  N. (cf. p. 291) the seaward line of heights is half sunken beneath the sea, forming islands. Between them and the mainland sunken valleys form a sheltered seaway, and fiords penetrate the high land : a lovely coast, to be compared with that of Norway. Inland the north and south direction of valleys is marked in the middle courses of the chief rivers, such as the Fraser, the Columbia with its tributary the Snake, and the Sacramento, but these in their lower courses break westward to the sea through the coastal ranges. Thus are formed valleys of the shape  $\neg$  or  $\neg$ H, of which the clearest illustration is given by the valley of California (Sacramento river and tributaries) and others which have their outlet at San Francisco, on the coast south of  $50^{\circ}$  N. where the seaward valleys are not below sea-level as farther north. The Colorado river enters the Gulf of California from the north.

Wonderful works of erosion are seen in this mountain system. The signs of glaciation during the ice age, which on the Atlantic coast reach southward to  $40^{\circ}$  N. lat., and in the interior as far as the junction of the Mississippi and Missouri, extend on the Pacific shores only as far as the fiord coast. Northward of this point many signs usually connected with the work of glaciers are seen : such are the steep rounded heads (cirques) of the valleys, and the so-called hanging valleys tributary to the main valleys and less deeply eroded than they, so that the streams now draining them form falls to the main rivers below. There are many very beautiful lakes. Southward from the Columbia valley the whole highland system has more of a plateau form than farther north, though still bounded and crossed by many mountain-ranges. The interior of the plateau south of the Snake valley is a dry region (p. 305), and here many basins have been filled with soil from the erosion of the mountain-slopes, which may be valuable for cultivation if it can be watered. But parts are desert ; and some of the basins contain salt lakes without outlet : the Great Salt Lake near lat.  $40^{\circ}$  N. is the most notable of these. The basin of the Colorado river, in the south, is one of the world's wonders in physical geography. In this dry region there has not been that smoothing and sloping of the sides of the valleys which is more commonly seen ; but the river and its

tributaries have cut deep gorges in the plateau, and thus have formed the Grand Canyon of the Colorado and many others. (*Canyon*, meaning a deep gorge with a river, is adapted from a Spanish word meaning, originally, a tube). The canyon of the Colorado reaches a greatest depth of 6,000 ft.—a full mile—let any one who, from some gentle slope, has seen a river a mile away across country, try to imagine what it would be like to look at that river a mile downward over a succession of sheer cliffs and terraces. The river cuts through stratum after stratum of the earth's crust: even down to the seventh below the surface, and at the bottom men have traced the folds of a very ancient mountain system whose relief has wholly disappeared. The walls of the canyon show different colours as the strata differ; the colours add to the marvel of the scene, and from them the Colorado, the 'coloured' river, has its name.

At some points, principally in the extreme north and south, there are active volcanoes, part of the volcanic ring around the Pacific Ocean; and at many more there are signs of volcanic action in the cleanly-moulded cone-shaped mountains and vast sheets of ancient lava. Elsewhere, again, though volcanoes are not active, there are geysers or hot springs,<sup>1</sup> some of which send up fountains of boiling water and steam: such are found in Yellowstone Park, a district of splendid scenery which is preserved, together with its trees, plants, and animals, as far as possible in its natural state. There are other such districts so preserved, so that men may not, by cutting trees for timber, working for minerals, and killing the wild creatures, destroy and lose record of the natural wonders of the region. It is a fine thing, this preservation of beautiful tracts; a thing which in Great Britain, long closely populated by civilized man, can no longer be done so well, though in recent years something has been attempted.

*Climate*.—The Arctic Circle crosses the far north and north-west of the continent; the Tropic of Capricorn crosses Mexico. By far the greatest part of the continent, therefore, is within the temperate latitudes. Throughout the central part of the continent, as in Europe and Asia, there is a much larger range of temperature than in the coast-lands generally. The isotherm of 32° F. in January skirts the Pacific coast as far south as 50° N. lat. and (the actual temperatures

<sup>1</sup> Part II, p. 438.

being, as usual, 'reduced to sea-level') curves south-eastward inland to the junction of the Mississippi and the Ohio rivers. It cuts the Atlantic coast about  $40^{\circ}$  N. lat., suggesting that the northern Atlantic coast-lands are colder in winter than those of the Pacific. And so they are, for not only does a cold continental interior lie to the west, but also the air is cooled by a cold current (the Labrador current) which passes southward from the Arctic region in this part of the ocean. The western (Pacific) coast, on the other hand, is

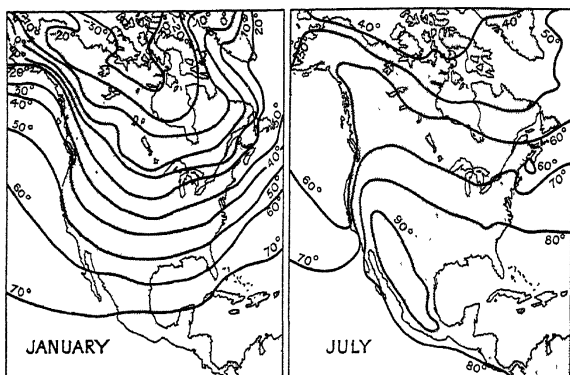


FIG. 97. ISOTHERMS (temperatures reduced to sea-level).

washed by warmer waters, and the westerly winds reach it unchilled. We may compare the conditions in the British Isles and western Europe: the mild oceanic winter climate in the westerly wind-belt covers a larger part of Europe than of North America, for in Europe there is no western mountain-system to limit the region of equable temperature. While the climates along most of the Pacific coast-land may be compared with those of Europe according to latitude, we have only to travel inland beyond the coast ranges to find conditions like those of central Europe.

In summer, the isotherm of  $70^{\circ}$  F. in July (for example), crossing the Pacific coast about  $35^{\circ}$  N. lat., runs north to about  $50^{\circ}$  N. before turning eastward and a little southward; it passes through the region of the Great Lakes, and crosses the east coast, near  $40^{\circ}$  N. Broadly it may be said that most of the continent south of  $50^{\circ}$  N.,

except at high elevations and on the northernmost parts of the coasts, has hot summers. The dry basins in the southern interior of the western mountain region are largely desert because they are barred off from rain-bearing winds by mountains both east and west ; and the daytime heat in summer may be very great, to be compared with that of the Sahara desert in Africa, so that evaporation is strong.

It is a point of interest that as the influence of the oceans is to make more equable the climate of the coast-lands, so also, though to a much less extent, is that of the Great Lakes. The summer temperature of their shore-lands is not quite so high as that of places 20 or 30 miles away, and in early winter their waters retain heat enough to moderate the intense cold. But this effect does not remain, and the lakes themselves in winter are more or less icebound.

*Winds.*—There are certain special features to notice in connexion with the winds of North America. The chinook wind (which bears the name of a former tribe of American Indians) is a westerly wind which, having blown over the western mountains, descends warm and dry upon the western parts of the central plains. It is to be compared with the föhn wind of the Alpine region in Europe. In winter it may raise the temperature suddenly from far below the freezing point to something well above it, and melts heavy snow in an extraordinarily short time. The tornado, also called cyclone, but under that name not to be confused with the ordinary cyclone or depression, is a violent whirlwind as its name of Spanish origin implies. The whirl may not be over 100 or 200 yds. in diameter, but it destroys everything in its path, which may be twenty miles long. Thick, dark cloud is formed in the whirl, which probably is set up in unstable air where cool dry northern and warm moist southern currents meet. These tornadoes are most common in the plains of the Mississippi and Missouri about and above the junction of these rivers, and in hot summer weather. The West Indian islands and surrounding seas, and sometimes the coast of the Gulf of Mexico, are subject to hurricanes, another form of cyclone but of much wider extent (50 to 1,000 miles diameter), which also do much damage and occur mostly in summer. The word ‘hurricane’ has come into common use for a heavy storm of wind ; but its origin is found here, in one of the native languages of the West Indies.



*Rainfall* in North America is heaviest along the southern part of the Pacific fiord coast (60-100 in. or more on the year's average), parts of the eastern coast of Mexico, and the eastern seaboard from

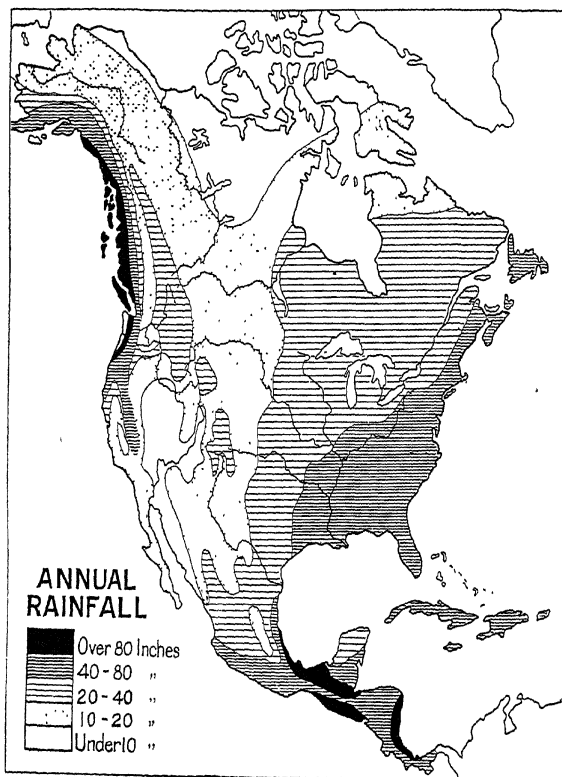


FIG. 98. MEAN ANNUAL RAINFALL OF NORTH AMERICA.

Newfoundland southward, including the whole southern Appalachian region and the plain of the lower Mississippi. It is least in the south-western desert area; and it is small in a belt of sheltered valleys between the mountains much farther north, as far as the Fraser river. The eastern part of the continent from the St. Law-

rence to the extreme south, including the region of the Great Lakes and the Appalachians, with the eastern plains, have a moderate rainfall at all seasons. From the Great Lakes to the east coast and

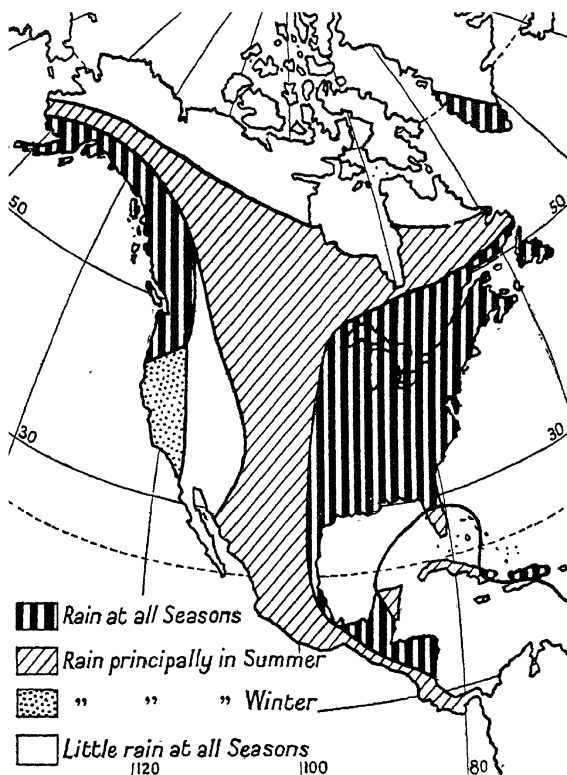


FIG. 99. SEASONAL RAINFALL IN NORTH AMERICA.

Newfoundland there is a region where precipitation is heavier in winter than in summer, which is exceptional in temperate lands bordering or lying toward east coasts. The wide inland water expanses—the lakes and the Gulf of St. Lawrence—have an effect

upon the air above them which helps this unusual condition. The Pacific fiord coast has rain at all seasons. South of this, from the Columbia river to the Valley of California, extends that part of the coastal belt which receives the moist westerly winds from over the Pacific Ocean in winter, but the dry easterly winds in summer; winter therefore is the wet season, and this region compares with the more extensive region around the Mediterranean Sea in Europe and Africa which has the same conditions. Behind this region lies the dry plateau region already mentioned. The western plains in the south, and in the north the whole expanse of them, have precipitation chiefly in summer. The southern plains of the lower Mississippi, with prevailing moist winds in summer from the Gulf of Mexico, and dry winds from over the land in winter, have conditions which may be compared to those of the monsoons, though much less strongly marked than the monsoons of Asia. Along the foot of the Rocky Mountains southward of  $50^{\circ}$  N. rainfall is not heavy, and a great deal of this south-western belt of the plains is decidedly dry.

In winter North America, northward of about  $40^{\circ}$  N. lat., is a snowy land except along the Pacific coast. Some parts, in the western mountains and the Laurentian region, receive a very heavy snowfall; and even where, as over the western plains, the snow is as a rule less deep, it lies long in the freezing winter unless the warm chinook melts it away.

*Vegetation.*—In the far north the ‘barren lands’ or cold wastes of the tundra region stretch from near Belle Isle Strait, the northern entrance of the Gulf of St. Lawrence, in the east, to the shore of Bering Strait in the north-west. South of this, the northern belt of coniferous forest crosses the continent from the Laurentian highlands to Alaska. These two vegetation belts continue the similar belts in Asia and Europe around the Arctic region. The Laurentian highlands bear extensive forests of conifers, with birches, poplars, and maples; and the forest belt extends through the Appalachian region southward, the conifers in that direction becoming less numerous, while the oak, plane, hickory, elm, chestnut, walnut, and other deciduous trees flourish. Along the St. Lawrence, on the borders of the Great Lakes and to some extent north of them, and to a much greater extent on the coastal lowlands to the south and the western slopes toward the Mississippi, land has been cleared for

agriculture, just as in western Europe much of the natural forest is lost. Over the plains west of this belt and south of the northern forests, the rainfall, not heavy, favours the growth of grass but not

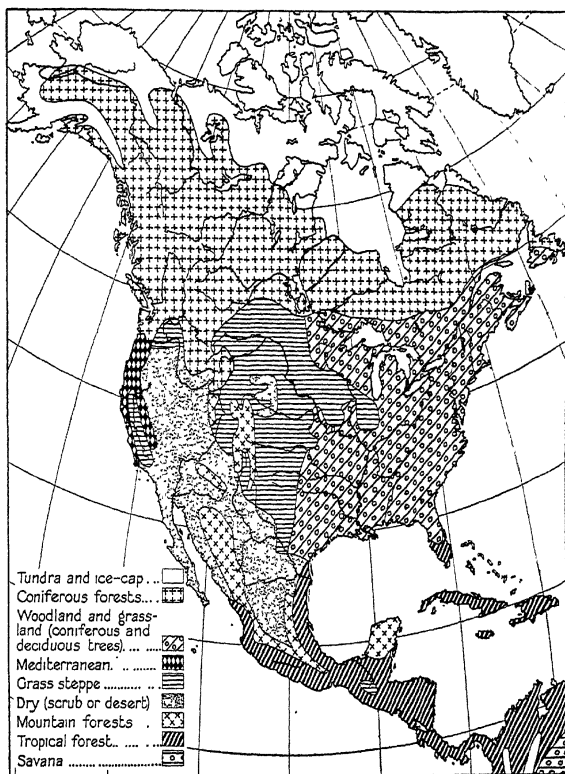


FIG. 100. NATURAL VEGETATION OF NORTH AMERICA.

of trees, which are few except along the rivers. Passing westward beyond the Great Lakes, for example, the traveller leaves the forest almost suddenly, and comes upon the wide expanse of plain, seen to a horizon like that of the sea, impressive because of its bigness, but with nothing of beauty like that of the forest and mountain regions.

But the plains, as we shall see, are rich in cultivation, especially in that central part where deep soil of glacial drift is found (p. 294). These are the lands famous under the name of the prairies, a term of French origin, connected with a Latin word meaning a meadow. The grass-lands extend to the foot of the Rocky Mountains, becoming drier to the west as we saw (p. 308); we shall find how the difference in moisture affects the kind of farming carried on—for the plains form one of the world's greatest farming regions.

The western highlands are magnificently forested where they are not too high or too dry; on the Pacific slope certain kinds of conifer grow to extraordinary heights—300 ft. or more, with noble straight trunks which may be 20 ft. in diameter at the base. The mediterranean region of the Pacific coast (p. 308) has characteristic evergreen vegetation; evergreen also is that of the Gulf coast. Dense tropical vegetation appears in southern Florida and along the low coasts of Mexico. But Mexico consists mainly of a high plateau, and the forest changes from tropical to temperate on the higher slopes, while the upper levels of the plateau are grass-lands, and the high mountains carry belts of conifers, and, near their summits, vegetation like the low plant forms of the tundra. So that here, from foot to summit of the mountains, we find belts of vegetation which may be compared with those found through the whole extent of the continent from south to north. The dry plateaux and basins of the western mountain-system, unless entirely desert, bear fat cacti and other fleshy plants adapted to want of moisture.

*Population and Political Division.*—We have in North America a land which, except in the extreme north and parts of the southwest and south, is fitted by its climate for white men to live and work in. It became known to Europeans during a period which began not much more than four centuries ago, and its native inhabitants (whom we shall notice presently) were neither many nor highly civilized. We have found already some hints of its natural wealth and advantages—its widespread forests, its vast tracts of rich agricultural and pasture land in the central plains, the rivers and lakes which offer lines of communication through great parts of it, the waterfalls which provide power for manufacture. To these must be added riches which we have not yet considered—mineral fields, fisheries, and so forth. Here, then, was a 'new world' indeed, in which

adventurers from Europe might seek fortune ; and the movement of men from European lands, which began, it may be said, only in modern times, has resulted already in the establishment of two great English-speaking nations, American and Canadian, and continues steadily.

The political division of North America is simple. (1) The north of the continent, excepting the north-western territory of Alaska

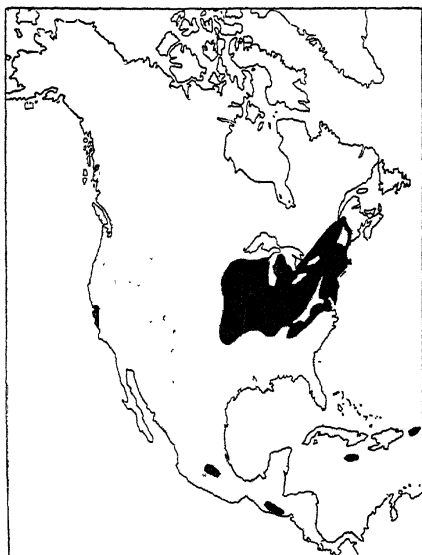


FIG. 101. The parts of North America where the population is densest (shown in black) and scantiest (in white).

and Labrador bordering the east coast, comprises Canada, one of the great dominions of the British Empire. (2) The island of Newfoundland forms a separate British colony, to which Labrador is attached politically. (3) The south of the continent, as far as the Gulf coast and the border of Mexico, is occupied by the republic of the United States of America, to which also Alaska belongs. This great republic has adopted the name of the continent : its government is called the American government, its people the American nation. (4) Mexico is an independent republic.

## North America

*Political Boundaries* in North America are in large part artificial. That between Alaska and Canada follows a line of longitude ( $141^{\circ}$  W.) from the Arctic coast nearly to the Pacific; then it runs south-east following the coast-line at a distance of 30 miles inland, and giving to Alaska a strip of mountain slopes and islands known as the Panhandle—the reason for this name will appear from the map. The boundary between Canada and the United States runs along the strait south of Vancouver Island, but from the Pacific coast of the mainland it follows the line of  $49^{\circ}$  N. lat. across the western mountains and the central plains, where there are no natural features to furnish an east-and-west boundary, until it reaches the Lake of the Woods about long.  $95^{\circ}$  W. Then it follows rivers and lakes to Lake Superior and passes through the Great Lakes, excepting Michigan, so that their northern shores, excluding the north-western shore of Superior, are Canadian, and their southern shores American. Lake Michigan is wholly American. The boundary next follows the river St. Lawrence as far as  $45^{\circ}$  N. lat., runs along that line, and then in an irregular course marked partly by watershed and river, but partly artificial, to the Atlantic coast at the Bay of Fundy. The whole of the lower St. Lawrence is Canadian, with the mainland shores of the Gulf of St. Lawrence and the peninsula of Nova Scotia. The boundary of the United States with Mexico follows artificial lines (in part neither meridians nor parallels) from the Pacific coast to the Rio (river) Grande, which, over the greater part of its course, forms the rest of the boundary to the Gulf of Mexico. The boundary of Mexico with the Central American state of Guatemala and the British territory of Honduras, which border it on the south, is largely artificial. Canada is divided into provinces and territories, and the United States into states, in which again the same use of meridians, parallels, and other artificial lines for boundaries is seen where no convenient physical features exist.

*Immigration.*—The temperate habitable lands in North America have become the most advanced in arts, manufactures, and production, because they are inhabited by peoples descended from the great European peoples, and by emigrants from European countries continually adding to their numbers. In a century from 1820, the immigrants into the United States came principally from Britain and Ireland, Germany, Italy, Scandinavia, and Austria-Hungary

(as it was until 1918), in that order. Canadian immigrants, naturally, are in a still larger proportion British, but not at all wholly so. But immigrants and their children become quickly American or Canadian, and English is the common language, although many European languages may be heard, and in parts where many immigrants from one country have settled, newspapers in the language of that country may be found. Naturally the part of the Atlantic coast most easily reached, especially from Britain, was the earliest settled by immigrants; and the group of six states bordering the Atlantic in the north-east of the United States is still known as New England. Many place-names, such as New York and Boston, commemorate the original homes of early settlers. All over North America (and in other similarly colonized lands) place-names will be found thus given, and sometimes the new towns have become far more important than the places in the old country after which they were called. Early Spanish settlers in North America, keeping mostly to more southern latitudes (as their home land is in relation to Britain), have left place-names such as San Francisco and Los Angeles in the 'mediterranean' region of the continent, and not only names but their language in Mexico. French people settled early in the St. Lawrence valley and in the Mississippi basin. In the second of these such names as St. Louis and New Orleans recall this settling, and we have already noticed (p. 300) the use of French words connected with the river. Along the St. Lawrence (principally its middle course), not only French names remain, notably those of the cities Quebec and Montreal, but there is a large French-speaking population within the British Empire, preserving its own customs and traditions.

*Negroes* are the most numerous of the coloured peoples in North America. They number about 10,000,000 and form nearly half the population in the south-east of the United States, where the climate best suits them. Their ancestors were brought here from Africa as slaves to work on cotton and other plantations: the negroes now, of course, are free, for there is slavery no longer. Chinese and Japanese immigrants are found in considerable numbers in the west coast-lands.

*Eskimos*.—Of the original native peoples of North America, the Eskimos are confined to the Arctic and sub-Arctic lands, extending



no farther south than the Labrador coast on the east, and on the warmer west coast less far. They are a coast people, dependent on the sea for almost everything since the lands they inhabit are so barren and cold ; they hunt and fish with skill, but the hard conditions under which they live keep them low in civilization. They extend to the arctic ice-capped land of Greenland, north-east of North America, where, under the rule of Denmark, there are a few small trading settlements, along the west coast mainly (p. 127).

*Indians.*—The peoples other than Eskimo whose ancestors inhabited America (north, central, and south) when it was discovered by Europeans, are still known generally as Indians. The name, rather curiously, has persisted since the time when Christopher Columbus and his followers, discovering the new world, still thought they had reached the Indies of Asia by sailing westward from Europe. The North American Indians were often called Red Indians from their reddish-brown complexions. They are few, and have not easily mixed with other inhabitants of the continent, save in Mexico. In Canada and the United States many still live in primitive condition, skilled in hunting and fishing, but not advancing far in manufacture, trading, and arts. In the far north such Indians are often nomadic, wandering freely, but elsewhere they have been given ‘ reserves ’ of territory, principally in the western mountainous regions, more rarely in the eastern, where they live under the control of the government, Canadian or American.

#### THE BRITISH EMPIRE IN NORTH AMERICA : NEWFOUNDLAND

The British island of Newfoundland is a part of the Appalachian mountain system separated from the mainland by the sinking of the land, and invasion of the sea through Cabot and Belle Isle straits, which give access to the St. Lawrence gulf and river. The island is a plateau with rocky, indented shores. It is covered in great part with coniferous forest which supplies wood-pulp for an important paper-making industry. There is a coal-field in the west, continuing that in Cape Breton Island closer to the mainland ; and there is valuable iron ore. But the chief wealth of the island is in its sea-fisheries. The continental shelf, covered by shallow sea and representing the sunken mainland, has a wide extent hereabouts, especially south-east of Newfoundland, and south of Cabot Strait along

the mainland coast. The Grand Banks (the parts of the sea-floor covered by shallow water are known as banks), south-east of the island, are the most important fishing-grounds, and the fish chiefly caught (among several) are cod, which are dried for export from St. John's, the capital of Newfoundland. This is not the only centre of the fishing industry, however, as the fishing-banks also extend

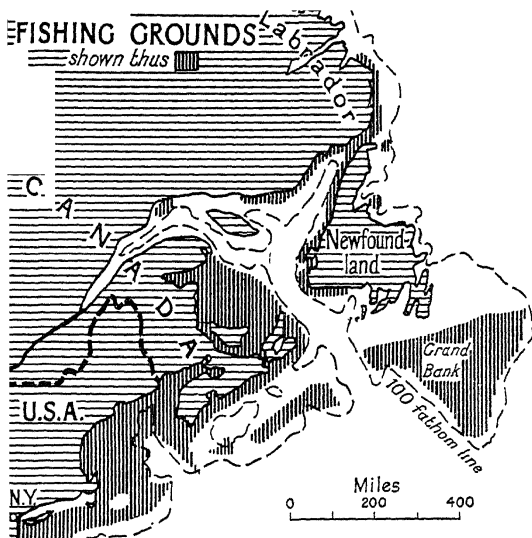


FIG. 102. The Newfoundland and neighbouring fishing 'grounds', which are seen to be on the continental shelf (within the 100-fathom line).

into the Gulf of St. Lawrence off the coasts of New Brunswick, Prince Edward Island, and Nova Scotia in Canada, also along the north coast (Quebec) and that of Labrador, as well as the United States coast to the south, so that all three countries have a share in the fisheries. France possesses two small islands off Newfoundland, St. Pierre and Miquelon, as a base for French fishermen. It has been found that the marine organisms on which the fish feed are brought to these banks by the cold Labrador current from the north. This current meets hereabouts the warmer water of the drift from

the Gulf Stream to the south. Under the different conditions of air-temperature over these waters of different temperature there is a strong tendency to the formation of fog, dangerous for the large amount of shipping in these seas.

The territory of Labrador, belonging to Newfoundland, extends inland over 300 miles along the parallel of  $52^{\circ}$  N., where there are valuable forests ; but narrows northward, bordering the coast.

### CANADA

*Eastern Canada : The Maritime Provinces.*—Dividing Canada rather more closely than we divided the continent into natural regions, and considering the chief occupations and products of each, we find first that in the extreme east, south of the St. Lawrence estuary and bordering the gulf, Canada includes some of the northernmost part of the Atlantic coastal lowland. This part is sometimes called the Acadian lowland. It includes the provinces of Nova Scotia, New Brunswick, and Prince Edward Island, with a small portion of Quebec. It is partly forested, and the forests, as elsewhere in eastern Canada, provide both timber and wood for pulping, supplying manufactures of paper and other things which are made of wood-pulp. The region is also important for mixed farming and fruit-growing, is rich in coal, and shares, as we have seen, in the eastern sea-fisheries. The ports of Halifax in Nova Scotia and St. John in New Brunswick are notable as the chief Canadian Atlantic ports in winter, when the St. Lawrence is frozen (as it is, on an average, from late November to late April) and access to the ports of Quebec and Montreal (p. 317) is stopped. Sydney in Cape Breton Island, Nova Scotia, is another leading port and centre of important coal and iron industries.

*The St. Lawrence Valley.*—The next division is that of the St. Lawrence valley, of which both shores are Canadian up to a point above the city of Montreal, and fall within the province of Quebec. This division also embraces the southern part of the province of Ontario, bordering the north shore of the upper St. Lawrence and Lake Ontario, and including the peninsula between Lakes Ontario, Erie, and Huron, sometimes called from its position the Lake Peninsula of Ontario. This region again, like that of the east, contains much rich land for mixed farming, including dairy farming,

and the Lake Peninsula, the farthest southern Canadian territory, has a summer climate warm enough to ripen grapes and is noted for many other fruits. The forests of the region are extensive, and the lumbering industry (as the working of the forests is called in North America) is well developed. Commonly the rivers tributary to the St. Lawrence are seen full of logs in summer, floating free or being towed in masses, from the forests where the trees have been felled, to the mills where they are to be sawn for timber, or pulped. The rivers in this region, falling from the Laurentian highlands to the north, supply immense water-power. Young as Canada is as an industrial country, this power is already largely developed, and it is of interest, incidentally, that Canadian skill in the development of water-power has also been applied in the far south of the continent, in Mexico. This region of Canada includes the principal manufacturing towns, and its wealth of water-power is the more important because it is far distant from the chief Canadian coal supplies. As far up the river as Montreal, coal must be supplied from Nova Scotia ; above Montreal, from fields in the United States.

The region contains more than half the total population of Canada, and nearly four-fifths of the manufacturing population. Characteristic Canadian industries are based largely upon the products of the country. Such industries are flour-milling, the making of cereal foods (from wheat), and the canning of meat, fish, and fruit. The wood industries form another large group, connected closely with water-power, as are chemical and electrical industries also. Manufactures have grown up to meet the needs of the country in agricultural machinery, railway plant, and motor-cars. The manufacture of iron and steel goods, and also of textiles, rubber goods and many others using mainly imported raw materials, are increasing.

Of the many big towns in the St. Lawrence region, Quebec, Montreal, Ottawa, and Toronto are the chief. Quebec, the first large port reached on the voyage up the St. Lawrence, is built on and around a height of historic fame on the north bank. For the largest steamers crossing the Atlantic to Canada, this is the highest point reached on the river. But all except the largest sail another 170 miles up-river to Montreal, situated also about a height (Mont Royal) which was a stronghold for early settlers. The site of the city

is close below the lowest rapids on the St. Lawrence and the junction of a big tributary, the Ottawa, from the west. Opposite to it, the south bank of the St. Lawrence is reached by the important natural route through the Appalachian Mountains, which leads southward into the United States, through the valley of Lake Champlain into that of the Hudson river, and so to New York. Ottawa, the capital of the Dominion, stands on the Ottawa river. Toronto stands on

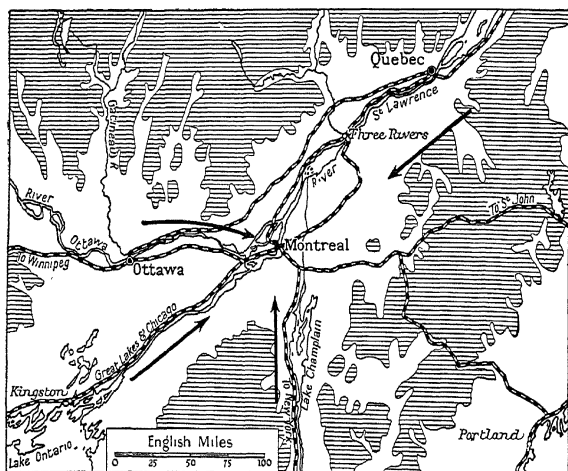


FIG. 103. THE POSITION OF MONTREAL.

a natural harbour on the west shore of Lake Ontario, and is a focus of land-routes through the whole Great Lakes region, Canadian and American.

*The Laurentian Highlands.*—The vast region of the Laurentian highlands, rocky and forested, is for the most part very sparsely inhabited; but population has concentrated here and there at mineral or forest workings, and there are stretches of agricultural land, as in the so-called clay belt in northern Ontario, to be developed. In the sparsely populated lands, both here and elsewhere, accidental fire is an enemy of the forests, and in travelling through them it is a common and a sorry sight to see the half-burnt trunks

of trees extending for many miles along the railways. The belt of forest—a thousand miles or more of it—between the populous region of the St. Lawrence and the agricultural lands of the centre and west, for long kept back the penetration and development of the latter, and still separates regions very different in interests and outlook. Development within the Laurentian region itself is for the most part new : its mineral wealth, however, is great. The mining of copper and nickel at Sudbury and of silver at Cobalt has been carried on for a considerable number of years, but more recently other mineral workings have been opened, and now northern Ontario, in particular, has some of the most important gold-fields in the world.

*The Prairie Provinces.*—We come next to the west-central plain region, extending from the Laurentian plateau to the western mountains, included in the provinces of Manitoba, Saskatchewan, and Alberta, and sometimes known picturesquely as ‘Canada’s thousand-mile farm’. The prairie wheatfields represent the very opposite condition of agriculture from that which we found in China and India, where many millions of peasants cultivate, each for his own supply, tiny plots of land by primitive methods. Here in western Canada a few thousand farmers cultivate each a great tract of country by means of the most modern machinery, and export their wheat to Britain and other lands where big populations must needs import because they do not grow enough for themselves. The wheat cultivation, trade, and traffic of the Canadian prairies offer one of the most interesting studies in the commercial geography of the British Empire. In three months of the autumn and early winter perhaps 200,000,000 bushels of wheat, or more, must be carried by railway from the fields to the ports of Fort William and Port Arthur near the head of Lake Superior. From there the wheat is carried by ships to the east, as water-transport is cheaper than rail transport. For the same reason the wheat from some of the western fields, which are nearer to the Pacific port of Vancouver, is taken there to be shipped ; and for further shipping eastward a railway is intended to be completed to Hudson Bay, of which the Arctic waters are free of ice long enough to let ships carry wheat away by that route. The land fit for cultivation in this region of Canada is not nearly all cultivated yet : perhaps not more than a quarter of it is cultivated. The conditions of climate, as suggested on p. 308, are on the whole

favourable to farming. Precipitation is not heavy; it is, on an average, from about 21 to 17 in. annually except over the south-west part of the plains, in Alberta. There it is less, and land must be irrigated for cultivation by canals, drawing upon rivers flowing from the western mountains. This division of the plains where not thus irrigated, and the foot-hills of the western mountains in Alberta, form fine ranching country. The important attribute of the rainfall over the plains generally is that most of it occurs during the growing season, from May to July or August, when three-fifths or more of the total precipitation of the year is received. Moreover, the decrease in total rainfall from east to west is largely compensated by the fact that in the west a larger proportion is received in summer. The winter snow protects the soil from the hard frost. In Alberta the warmth of summer is almost as great in the extreme north as in the south; the period of sunlight is longer according to the more northerly latitude, and this appears to help the plant life to quicker growth. Thus it comes about that in this north-western part of the plains, even as far north as the Peace River district, there is promise of large extension of cultivation. As wheat-growing extends westward, mixed farming tends to take its place in the east; we shall find that this has happened also in the United States.

In south-western Alberta along the edge of the western mountains this region contains extensive coal-fields. In the north rich supplies of oil are believed to exist. The subarctic region of the continent, from the Labrador peninsula right across to north-western Canada, still yields the fur-bearing animals such as in the earliest days of exploration by Europeans were trapped and traded by natives and pioneers.

Of the towns on the plains the chief is the city of Winnipeg, capital of Manitoba, and principal inland centre of the wheat trade. It stands in the south of the province, between the southern end of Lake Winnipeg and the boundary with the United States. The main railway routes east and west converge upon it, for it stands—the map shows this—as in a gateway to the west, between the lake and the boundary. Regina is the capital of Saskatchewan, centrally situated on the southern prairies. In Alberta, Edmonton, the capital, stands on the North Saskatchewan river, looking westward to the Yellowhead Pass through the western mountains (p. 323) and

northward to the Peace River district. Farther south, Calgary is on the Bow River, the upper valley of which carries another important route westward into the mountains (p. 323).

*The Western Mountain Region*, covering a strip of the province of Alberta and the whole of that of British Columbia, has fertile valleys in the south specially noted for apples and other fruits. These interior valleys—the Okanagan and others—have a fine dry ripening season. The extent of forests is very great, and the lumbering

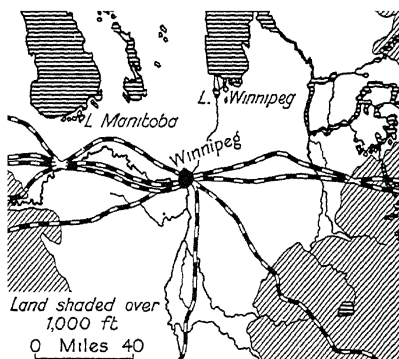


FIG. 104. THE POSITION OF WINNIPEG, a meeting-point of railways.

industry large. Minerals, including lead, copper, coal, zinc, silver, and gold are found in several parts. There is a big industry in catching and canning (or tinning) salmon. The swift, full rivers afford immense water-power, little developed in proportion to its amount. The splendours of the mountain and coast scenery draw many visitors. Vancouver, in the south-west, is one of the two chief ports in North America for trans-Pacific traffic (San Francisco in the United States being the other), and Victoria, on Vancouver island, a smaller port, is capital of the province. A third port is Prince Rupert, farther north, reached by railway from the east, but not yet fully developed. The coast, sheltered by mountains and islands, offers grand natural harbours. Except in the south (and even there in large part) this mountainous land is sparsely inhabited ; vast tracts of it not at all.



*Commerce.*—Having considered the chief products of the various regions, we may now make a summary of the chief exports. They include wheat and flour, lumber (timber), paper, woodpulp, meat and animals, machinery (agricultural, motor-cars, &c.); oats, barley, and rye among field crops other than wheat; butter and cheese; fish (mainly salmon), and furs. These things make up probably over three-quarters of the total exports of value, excluding



FIG. 105. THE POSITIONS OF VANCOUVER AND VICTORIA, on the beautiful island-fringed coast of British Columbia.

metals (gold, copper, nickel, &c.). Recalling our description of the land, it should be noticed how these exports may be grouped—as products of the farm and ranch; of the sea and inland waters; of the forests and mines; and of manufacturing industry.

*Communications.*—The principal railway systems in Canada are those of the Canadian Pacific Railway and the Canadian National Railways. The first is worked by a company, which also works steamship services, trans-Atlantic and trans-Pacific, and thus provides a British route from Britain, across two oceans and a continent, to Eastern Asia. The second consists of a number of systems, formerly independent, which have been brought together

under state control. Each of these two provides a main transcontinental route, and connexions with all the principal cities and populated districts of Canada, and with the railways of the United States. By the transcontinental lines the eastern cities are connected with Winnipeg. Thence westward, the Canadian Pacific, the older line, takes the more southern route across the plains, the first part to be opened up, and also the more southern route through the western mountains to Vancouver, by way of Bow River valley, the

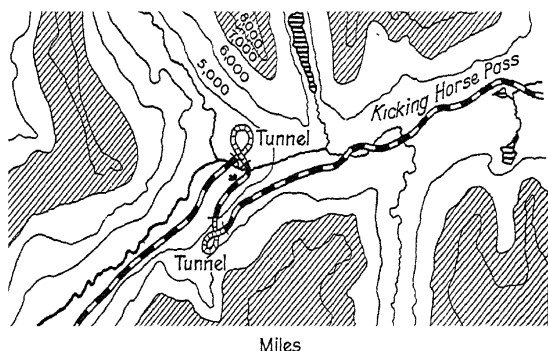


FIG. 106. The route of the Canadian Pacific Railway from Kicking Horse Pass westward through the Rocky Mountains; in order to make a sufficiently gradual slope the line must be carried through tunnels making loops, so that each tunnel, in its descent, passes underneath its own upper part.

Kicking Horse Pass across the Rockies, and the Fraser River canyons—for scenery, as for engineering skill, the most wonderful railway routes in the world. The Canadian National line finds an easier pass through the mountains—the Yellowhead Pass—and sends branches through British Columbia to Vancouver and to Prince Rupert.

#### THE UNITED STATES OF AMERICA

*Distribution of Population.*—The area of Canada is over  $3\frac{1}{2}$  million sq. miles and the population  $9\frac{1}{2}$  millions. The area of the United States of America, including Alaska, is 3,000,000 sq. miles and the population 113,000,000. A much larger portion of Canada, in its Arctic, sub-Arctic, and mountainous parts, is very sparsely populated

There is not, however, in Canada, any very densely populated part, with large towns close together, such as is found in the north-eastern United States. Here the Atlantic coast-land as far south as  $35^{\circ}$  N. has great cities, centres of commerce, manufacture, and shipping, and the lowlands behind it are thickly populated. The Appalachian uplands are generally thinly populated except where minerals are worked. But to the west of them, over the region of the prairies, extending from the Great Lakes to the lower Ohio and Missouri rivers, there is a populous area of immense importance both in agriculture and in manufacture. As a whole, the states east of the meridian of  $105^{\circ}$  W., excepting the south-easternmost state of Florida, have a much larger population than the states west of that meridian, which roughly marks the eastern limit of the western mountain region. This region, it may be observed, is much wider in the United States than in Canada. Its population is mostly centred in certain districts, as, for example, around some of the rich mineral districts which we shall notice presently, and in the north-west in the valley of the Columbia River and the south-west in that of California.

*Agricultural Divisions.*—According to the chief agricultural products, the United States may be divided into six districts. In the New England States of the north-east, that is, from about  $40^{\circ}$  N. southward, there is mixed farming such as we find in eastern Canada; and dairy-farming is specially important in the state of New York for the supply of the big cities. In the region west of the Great Lakes as far as the foothills of the western mountains is found a southward continuation of the great Canadian wheat-fields, especially in the rich valley of the Red River, which runs northward to Winnipeg and Lake Winnipeg in Canada. As the population of the United States increases the amount of wheat which can be spared for export tends to lessen. The great farms where wheat is grown for export on a large scale have moved farther westward as the population in the east has grown and mixed farming for its supply has become more profitable. To the south of the wheat belt, roughly  $5^{\circ}$  on either side of  $40^{\circ}$  N., a principal crop, in addition to wheat, is maize, known to us also as Indian corn, or in America simply as corn, a word which is not applied to wheat. Maize is cultivated in warmer and wetter regions than wheat because it bears

neither frost nor a very dry summer. The moderate summer rainfall of the Mississippi basin suits it. South of the maize belt is a belt in which the most important crop is cotton. For this at least half the year must have a warm temperature without frost, and a fair rainfall, though too much rain is destructive. We found in India that the monsoon type of weather is suitable for cotton provided that the cotton-lands do not receive the heaviest monsoon rains. The climate of the warm south-east of the United States is somewhat of the monsoon type, the heaviest rains being from April to August when the cotton is sown and grown, and drier during the following two months when it is picked. The rich soils of the lower Mississippi basin, and particularly in Texas, are good for cotton, and a fine sort is grown on the islands off the Atlantic coasts of the states of Georgia and South Carolina. This is called sea island cotton.

*Live stock, Fruit-growing, &c.*—The cordilleran region of the west includes the dry lands where irrigation is generally necessary for agriculture, and this has been widely extended, as for instance around Salt Lake City. In parts not irrigated and naturally too dry for agriculture, but not for grass, live stock is important and great cattle ranches and sheep farms are found, principally in the states on the western slopes of the mountains and the high plains. The rearing of pigs, more commonly referred to as hogs in America, is carried on principally in the states south of Lake Michigan and in the middle Mississippi valley.

The extreme western states, in the valleys of the Columbia River and California already mentioned, and in other smaller valleys, have a fine extent of land valuable for grain-growing and also are noted for fruits, California being the leading state for grapes and various mediterranean or sub-tropical fruits. The other principal fruit-growing district is in the middle east, between the Atlantic and lakes Ontario and Erie, while the south-east, especially Florida, produces tropical fruits, such as pine-apples. In the land toward the mouth of the Mississippi, particularly in the state of Louisiana, the sugar-cane is grown; and in this same state and farther west in Texas rice is an important crop, being used largely by the negro population. The south-eastern district extending from the lower Mississippi to the Atlantic, and including the states of Kentucky, Virginia, and others, is noted for tobacco, to one kind of which the state of

Virginia gives its name. The lumbering industry is most highly developed in the states of Mississippi and Louisiana (bordering the lower part of the Mississippi river), in the southern part of the Appalachian region, and in the north (Lake Michigan, &c.) and north-west (Columbia basin).

*Manufactures and Minerals.*—The north-east contains most of the great manufacturing districts where the population has been longest settled and the Atlantic ports are most easily accessible for European and other trade. Raw cotton, besides being one of the principal exports, supplies also large home industries, carried on in the New England states of Massachusetts and New Hampshire as well as nearer the sources of supply of raw cotton in North Carolina and neighbouring states. In this last district the cotton factories are often close beside the fields, and not in great manufacturing towns as they are farther north and in the cotton-manufacturing districts of Lancashire and Scotland. The north-east has also great manufactures of fabrics of many kinds, and of clothing.

The United States is rich in coal and iron. The two most important iron-fields are that west of lakes Michigan and Superior and that on the south-western slopes of the Appalachian Mountains. The iron ore of the lake region is smelted mainly at Pittsburg in the big manufacturing district south of Lake Erie, where coal is plentiful and natural gas also supplies a fuel of special importance in iron-smelting. Petroleum also is found in this region. In the more southerly part of the Appalachians, in Alabama, coal and iron are found together and large metal industries have grown up in a group of towns, of which Birmingham is the centre. Out of the iron and steel industries many others have developed, especially the mechanical industries; and such things as sewing-machines, typewriters, motor-cars, and agricultural machinery from the United States are well known to us.

The use of water-power has been largely developed. The Fall Line along the foot of the Appalachians has already been mentioned: it has led to the establishment of many industries in the towns along this line. Especially important as town sites are those on rivers where, below the falls, the waters are navigable from the sea. Examples are provided by the cities of Philadelphia and Baltimore.

The industries connected with agricultural products are, of course, important. A further example of the use of water-power is provided

by the flour-milling industry of the city of Minneapolis, which has grown up at the falls of St. Anthony on the Mississippi. An immense industry in meat-packing, connected with the rearing of hogs and cattle, is established in the cities of Chicago on Lake Michigan, St. Louis at the junction of the Mississippi and Missouri, and other centres easily reached from the districts where live stock is chiefly reared.

Among exports next in importance to food products are those of copper and its manufacture, wood and its manufactures, leather, and tobacco. The chief districts for copper-mining are in the peninsula of Michigan, east of the lake of that name, and also in the north-east and south-west of the western mountain region, in the states of Montana and Arizona respectively. Among other minerals, gold is produced principally in the mountain states of Colorado, California, and Nevada, and in the mountain region lead, zinc, silver, and other metals are also important. From this it is clear that the western mountain region is the principal source of metals excepting iron and the copper of Michigan. Other mineral products of special importance are tungsten, used in the manufacture of electric lamps; also phosphates, and sulphur, the last of which comes almost wholly from Louisiana. The principal oil-fields are in California, in Kansas and Oklahoma on the east side of the mountains, with Texas and Louisiana farther south, and also in the region around Pittsburg and as far west as the middle Mississippi. Oil was formerly a large export, but even more than in the case of wheat the home demand has caught up with the supply.

*Communications : the Position of New York.*—The north-eastern part of the Appalachian mountain system is broken up into many ranges and traversed by a number of valleys affording communication between the populous districts on the east, or Atlantic, side and on the west toward the Great Lakes. Of these valleys by far the most important, as has been suggested already, is that of the Hudson River, which gives access northward to the valley of Lake Champlain and the river St. Lawrence and westward through the Mohawk valley to the Great Lakes. At the mouth of the Hudson is situated New York, the largest city in the United States and one of the greatest ports in the world. It owes its foundation to a site on a peninsula with a fine natural harbour at the river mouth, and its

later development largely to the importance of the Hudson-Mohawk route to the west. The valleys afford both water communication by the river and by canals through the Mohawk and Champlain valleys, and routes for railways. The railway gradients are easy compared with those of others across the mountains, so that although the route to the west forms two sides of a triangle it is even more important

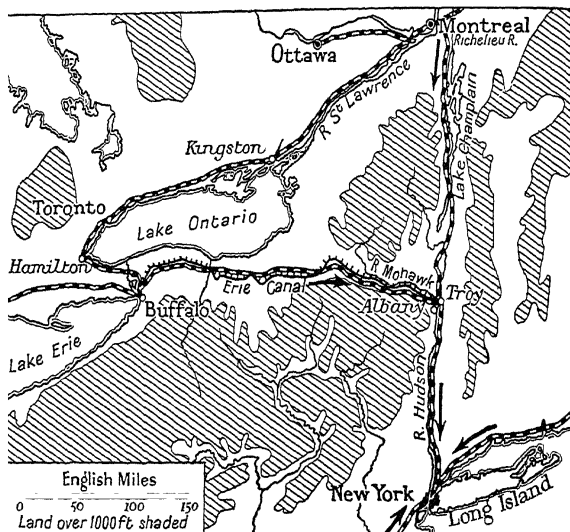


FIG. 107. THE HUDSON-MOHAWK GAP and the positions of New York, Buffalo, and Montreal in relation thereto.

than a shorter line from New York to Lake Ontario, which forms the third side of the triangle. New York is both a commercial and an industrial city of the very first importance. It has far outgrown its original peninsular site, which itself has become so important as a commercial centre that its buildings have been carried to an immense height and are known as 'sky-scrapers'. These give the city a wonderful appearance from the harbour, for many of them are noble buildings, but the streets between them are like the gorges of a mountain range, without its beauty.

*Cities of the Atlantic Sea-board.*—The chief seaport of the New

England states north-east of New York is Boston, placed on a fine natural harbour at the junction of several valleys, but with rather difficult railway communication westward through the hills to the Hudson-Mohawk valley. To the south of New York a number of river estuaries branching through the coastal lowland, the most extensive of which is Chesapeake Bay, form natural harbours for several large ports, such as Philadelphia and Baltimore, which have already been mentioned as manufacturing cities also. The city of Washington to the south-west of these, at the head of the estuary to the Potomac, is the capital of the United States, built on a beautiful site in a small territory which belongs to no one state but to the federation, and is called the District of Columbia. Washington was built as the capital in order to avoid jealousy between any of the states, whose great cities might have claimed the honours. The foundation of the new capital city of Canberra in Australia (p. 372) may be compared.

*Communications and Cities in the Central Plains.*—Railway routes westward from New York, as mentioned already, converge upon the narrow plain south of Lake Ontario and upon the city of Buffalo at the eastern end of Lake Erie near the crossing of the Niagara river, which cuts through the isthmus between the two lakes. This isthmus forms as it were a bridge between the Lake Peninsula of Canada and the northern United States. The city of Cleveland is centrally situated on the south coast of Lake Erie and that of Toledo at its western end. The isthmus between Lakes Erie and Huron forms another bridge between the Lake Peninsula and the centre and north-west of the States. Here is situated the city of Detroit. Again, at the isthmus between Lakes Huron and Michigan to the south and Lake Superior to the north are the twin Canadian and American towns of Sault Ste Marie. This isthmus provides a direct route from Montreal in Canada to the west and north-west of the States. A map will show that other routes from the east to the west and north-west must round the southern extremity of Lake Michigan; and here, in a natural situation for a great city to be the junction of many routes, is the city of Chicago. The more southerly routes crossing the north-eastern Appalachians follow the valleys of the Susquehanna and Potomac and converge upon the city of Pittsburgh. From here trunk lines continue to Chicago and to St. Louis



at the junction of the Missouri and Mississippi, reached also by a direct line from the east through the manufacturing city of Cincinnati on the river Ohio, the great eastern tributary of the Mississippi.

To complete the summary of the principal main railway routes in the east it may be added that the main line south-westward from New York and Washington runs east of the mountains to the plain bordering the Gulf of Mexico and the principal port of that Gulf, New Orleans, on the north side of the delta of the Mississippi. This is the principal of several ports for the export of cotton.

*Navigation on the Mississippi.*—We have already noticed the large extent of inland navigation provided by the Mississippi and its tributaries, and it may be added that the main river is navigable for fairly big steamers and barges from the mouth past St. Louis and upward to Minneapolis; while the Ohio, except for rapids which are surmounted by a canal at Louisville, is navigable to Pittsburg. These portions of the much longer total extent of navigable waterways in the Mississippi basin are the most important; and even though the greater part of the basin is covered with a close network of railways, the river navigation remains of much importance to trade, especially for carrying heavy and bulky products such as coal and timber.

*Transcontinental Railways and Western Cities.*—There are six main railway routes across the western mountains in the United States. In the north one runs westward from Duluth at the head of Lake Superior and also from Chicago and Minneapolis, and passes westward to the Columbia River basin and its ports on Puget Sound, the principal of which is Seattle. Another route runs more directly from Minneapolis to the same point, passing through the Yellowstone region. A route westward from Chicago crosses the Missouri at Omaha and passes over the shallow Great Salt Lake near Salt Lake City and so westward to the valley of California, serving San Francisco. This, the principal Pacific port, situated on a magnificent natural harbour, the best among the few on the Pacific coast of the States, is also reached by a railway from St. Louis, which ascends the valleys of the Kansas and Arkansas rivers and passes through Salt Lake City. Both the routes just mentioned serve by connexions the chief centre of the mining districts, Denver in

Colorado. Two more southerly routes through the mountains give access to Los Angeles in the south of California, the principal centre of the oil-producing district in that State. There is railway communication through the lateral valleys behind the coast ranges from Vancouver and Seattle to Los Angeles in the south-west, and there are connexions between the United States lines and Mexico.

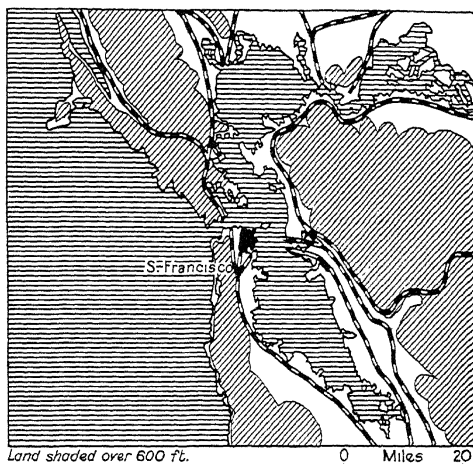


FIG. 108. THE POSITION OF SAN FRANCISCO, at the entrance of a wide inlet giving access through the coastal hills to the valley of California.

*Railways and Settlement.*—Reference has been made to the close network of lines which may be seen on a detailed map covering the east and centre of the States with the exception of the southern Appalachian Mountains. And it may be mentioned that both here and in Canada railways have had an extraordinary importance in opening up new land to settlement. The railways were not built in lands which already had an extensive road system upon which, apart from water-transport, trade already depended—as they were, for example, in Britain. There is no such road system in North America, although with the great modern development of motor transport roads are being gradually extended, especially in the neighbourhood of the chief cities.

*Alaska.*—The territory of Alaska in the north-west of North America, belonging to the United States, is a mountainous land, especially in the south. Off the coast there are important seal and salmon fisheries. The country itself is rich in minerals, especially copper and gold, while coal and oil are also known. There is some timber industry and agriculture in the warmer south. Northward of the southern mountains the great river Yukon flows from the east to Bering Sea. It is navigable in summer when it is not ice-bound, and gives access to some of the mining fields. It is on the upper part of this river, within Canadian territory, that the town of Dawson is situated, once, for a few years, a city of many thousands of inhabitants when gold-fields newly discovered were easily worked, but now no longer of the same importance.

#### MEXICO

The republic of Mexico, south-west of the United States, occupies a plateau bordered on the east and west by high mountains and by a volcanic range on the south. Beyond this the isthmus of Tehuantepec and the peninsula of Yucatan are low-lying. The Gulf coast on the east, where the principal ports are situated, is sandy and low, and there are few good harbours. The difference of elevation gives Mexico three main zones of climate. Along the coast and up to about 3,000 ft. the hot belt is densely forested and yields tropical products, including the coco-nut and mahogany and other valuable timbers. Sugar, cotton, cocoa, and tobacco are cultivated and in the Yucatan peninsula especially hemp is one of the most important commercial products. In the warm zone, from 3,000 to 7,000 ft., sugar, coffee, oranges, and other fruits are grown, together with maize and other cereals. A considerable part of the plateau, however, is too dry for agriculture. Above about 7,000 ft. there is a cool zone with typical vegetation quite different from that of the lower zones. Mexico is very rich in minerals, especially silver, and in petroleum in the eastern lowlands. The chief Gulf ports are Vera Cruz and Tampico, the principal oil ports. The capital, Mexico City, and other important towns, are situated on the higher, healthier plateau. British as well as American interests are largely concerned in the oil-fields and mineral-fields of Mexico; but the disordered government of the country has been against its proper development in the past.

## CENTRAL AMERICA

The small republics of Guatemala, Honduras, Salvador, Nicaragua, Panama, and Costa Rica, together with British Honduras, occupy the narrow isthmus of Central America. Their products are

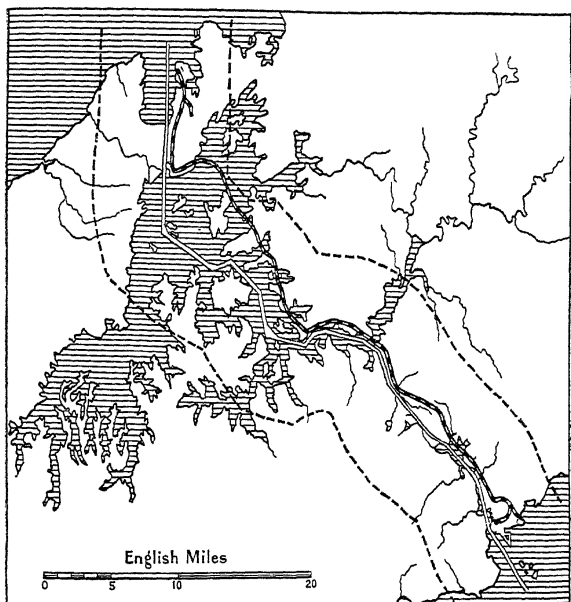


FIG. 109. THE PANAMA CANAL. The canal is shown by the double (parallel) lines; the seas and the lake through which the canal passes are ruled with horizontal lines; a railway is seen running near and east of the canal. The broken lines show the boundaries of the canal zone of territory controlled by the United States of America. The Caribbean Sea (Atlantic Ocean) is at the north-west corner of the map; the Pacific Ocean at the south-east.

tropical, including rubber, mahogany, coffee, and cocoa and many fruits, especially the banana, in which there is a very large trade with the United States. Another valuable vegetable product is chicle, from which chewing-gum is made. This and mahogany are among the chief exports of the colony of British Honduras, the capital of which is Belize.

*The Panama Canal* crosses the isthmus of Panama and connects the Atlantic and Pacific oceans ; it is fifty miles long and has six locks. This canal belongs to the United States and is one of the greatest engineering works in the world. As compared with the Suez Canal it does not reduce the distance from Europe to Asiatic or Australian ports, but it very greatly reduces the distance from North American Atlantic ports to Pacific ports generally, and from European to American Pacific ports, for before it was opened ships had to pass far to the south round Cape Horn at the extremity of South America. The Panama Canal therefore affects most especially the trade of Central and South American cities on the Pacific side, and the trade of eastern North America with Australia and New Zealand, the Philippine Islands, China, and Japan.

#### THE WEST INDIES

The islands of the West Indies, south-east of North America and north of South America, include the large islands of Cuba, Jamaica, Hispaniola, and Porto Rico, forming the Greater Antilles, and many smaller islands forming the Lesser Antilles. Generally they are mountainous, and many are volcanic and subject to severe eruption and earthquakes. Most are densely forested, especially on their eastern slopes where the tropical rainfall is heaviest in summer and autumn. The islands are liable to damage by tropical cyclones. They are, however, fertile and very beautiful, and are inhabited mainly by negroes of the same origin as those of the United States. The most important product is sugar ; bananas, tobacco, coffee, and cotton are among other valuable crops. Cuba is a republic under the protection of the United States ; Hispaniola is divided into the republics of Haiti and San Domingo ; Porto Rico is a possession of the United States ; Jamaica is the largest of a number of islands which belong to Britain. It is a mountainous and beautiful island with many rivers, and produces coffee, sugar, bananas, and many other fruits. Its chief town and port is Kingston, situated in an important position in relation to the Panama Canal, across the Caribbean Sea. Among the other British islands the Bahamas are low islands of coral, producing pine-apples and hemp. Of the Leeward Islands the chief are Antigua, with fields of sugar-cane and pine-apples, and Dominica, which grows limes and coco-nuts. The

forested volcanic Windward Islands produce sugar and cocoa. Barbados is dotted with sugar plantations; and Trinidad, close to the South American coast, grows cocoa, has oil-fields, and yields asphalt from a remarkable lake of pitch. The beauties of Jamaica and some of the smaller West Indian islands attract many visitors, especially from the United States. It may be added here that the peninsula of Florida is famous for many seaside health resorts visited especially in winter. Far out in the Atlantic, north-eastward of the West Indies, are the little British islands called the Bermudas. Here also the equable climate attracts visitors, and both tropical and temperate fruits and vegetables are grown.

## EXERCISES

1. Contrast the build and physical features of North America with Euro-Asia. Do you notice any points of comparison? If you do, indicate them.

2. Account for the presence of so many lakes in Canada. Compare this region with a similar region in northern Europe.

3. Draw a map of North America, showing the January and July isotherms. What do they suggest concerning the seasonal distribution of temperature?

4. Compare any of the great natural regions of North America with corresponding regions of the old world.

5. Describe the forests of Canada and their extent. What use is made of them?

6. Where are the great wheat-lands of Canada and the United States? Show them on a map, and describe the means by which the wheat is exported.

7. Describe the climatic and agricultural differences in the central lowlands of North America east and west of the line of  $100^{\circ}$  W. long.

8. Draw a map to show the maize belt of the United States. Describe the industries found in this belt, and name important centres.

9. Discuss the importance of the waterways of Canada east of the Rockies as a means of communication. Give a map.

10. Describe the position, and account for the importance of New York, Boston, Philadelphia, Baltimore, and Washington. Explain why New York has outstripped the others.

11. Compare (a) the mean winter and summer temperatures; (b) the range of temperature of Winnipeg, New Orleans, New York, San Francisco, Victoria. Draw diagrams to show these comparisons.

12. Describe the position of the great coal-fields of the United States. Give an account of the iron and steel industry, centred at Pittsburg.

13. Give an account of the manufacturing industries of the New England States. Account for their great development.

14. Discuss the natural resources of any of the following : British Columbia, Alaska, the Californian plain, Mexico, Newfoundland.

15. Draw a map of the main railways of Canada and briefly indicate the characters of the lands opened up by them. By what passes do the railways cross the western mountains ?

16. Write a geographical account of (a) the Mississippi basin ; (b) the St. Lawrence basin.

17. Describe the conditions of life in Greenland and that part of America north of  $55^{\circ}$  N. lat.

18. Discuss the influence of the Appalachian Mountains on the development of North America. Compare the density of population of the Atlantic lowland with that of the central plains.

19. Describe the physical features and the economic conditions of the mountain and plateau region of the western United States.

20. On a map show the areas which grow cotton and tobacco, and name the ports through which the cotton is exported. Compare the conditions under which these plants are grown in North America with those in other parts of the world. Name other plants of tropical North America.

21. Give an account of any of the following :

(a) the fruit-growing industry of Ontario ;

(b) the use of water-power in Canada ;

(c) the trade on the Great Lakes ;

(d) the production of petroleum in the United States.

22. Describe the position of the Panama Canal. What effect has its construction had upon the world's commerce, and what countries have benefited most ?

23. What different types of climate are found along the west coast of North America ? Give the limits of each type, and account for the differences.

24. Describe the regions passed through in a railway journey from New York to Salt Lake City, via Chicago, and give the positions of towns on the way.

## IX. SOUTH AMERICA

SOUTH AMERICA, with an area of about 7,000,000 sq. miles, stands fourth in size among the continents. Its shape is roughly that of a right-angled triangle, with a long narrow vertex pointing south, while the right angle is formed by the north-east and south-east coasts. The vertex formed by the right-angle reaches the most easterly point, and at the latitude of this point,  $7^{\circ}$  S., the continent is widest (3,000 miles). The extreme length from north to south is 4,700 miles.

*Position : the Map.*—For the map of the continent the central meridian is usually taken as  $60^{\circ}$  W.; the continent extends, at its widest, from  $35^{\circ}$  to  $82^{\circ}$  W., and in length from  $12^{\circ}$  N. to  $54^{\circ}$  S. The intersection of the meridian of  $50^{\circ}$  W. and the Equator fixes the position of the mouth of the great east-flowing river, the Amazon. The meridian of  $70^{\circ}$  W. gives the lie of the west coast south of  $18^{\circ}$  S. lat., and almost bisects the angle formed by the southern apex of the continent. The tropic of Capricorn crosses the continent almost exactly half-way between its northern and southern ends, and it cuts the east coast just south of the big port of Rio de Janeiro. South America is attached to Central and North America by the isthmus of Panama; it is worth remembering, when drawing the map, that it does not hang from this isthmus like a fruit from its stalk: the isthmus joins the mainland on the north-west side, and from that direction. It is worth remembering also that the Equator does not cut the continent across its widest part, but  $7^{\circ}$  to the north of it. The shape and position in comparison with other continents is also worth notice. The westernmost part of South America is in nearly the same longitude as the peninsula of Florida and Lake Erie in North America. The easternmost point of South America is in a longitude  $40^{\circ}$  more easterly than that of New York, and it is about equally distant from New York and the English Channel. The northernmost part of South America is no farther north than Nigeria and the eastern horn of Africa, so that practically the whole of the Sahara desert lies more northerly than South America, in the north of which there is no desert. But South America extends roughly  $20^{\circ}$  farther south than South Africa and Australia.



*The Americas and Africa : Comparisons.*—Both North America and South America are broadest toward the north and narrow to the south. So is Africa : and South America has an inward curve of the west coast about  $20^{\circ}$  S. lat., as Africa has just north of the Equator in the Gulf of Guinea ; but the South American curve is much less deep. Opposite this curve, but something more northerly in latitude, the easternmost point of South America is found, just as the eastern horn of Africa lies a little more northerly than the Gulf of Guinea. But South America has no sharp horn like the African. Over all it is narrower than Africa, and in figure, you might say, less heavily built. Both the Americas have high mountain systems on their western sides—the western mountain system of the north comparing with the system of the Andes in the south. Both have highlands in the east, much lower, however, than the western mountains. Both have extensive central plains, much of which, especially in South America, lies at very low elevations. In these respects there is a strong contrast with Africa, with its plateau form, its relatively small extent of lowland, and its high mountains in the east-central region. Both the Americas have great river-basins draining eastward to the Atlantic ; but whereas in North America the western mountain system is penetrated by deep valleys carrying big rivers to the Pacific, there is none such from the Andes in South America. As for Africa, the most interesting comparison is that of its great equatorial river-basin, the Congo, with the Amazon basin in South America, as we shall see later. Completing our broad comparison between the Americas, we may notice the broken island-coast, with deep inlets, facing the Pacific in north-western North America, and in south-western South America : on the other hand, South America has no such inlet in the north-east as Hudson Bay.

*Surface Features.*—South America has been called ‘the model continent’ because of its simple shape and construction. The coastline is very short relatively to the area, and in this it resembles that of Africa and provides a contrast with that of Europe. It averages one mile of coast to 435 sq. miles of surface, as compared with one mile of coast to each 180 sq. miles of Europe. The coastline is smooth, with few gulfs or bays of any importance. The estuaries of the Amazon and La Plata are the most important, but the entrance to the Amazon is partially obstructed by islands. To some

extent, the lack of inlets is made up by the great navigable length of the rivers. The grand divisions of the surface-features of South America are as simple as those of North America. They are : (1) the mountain-system of the Andes in the west ; (2) the eastern highlands ; (3) the north-eastern highlands ; (4) the plains or lowlands of the three great river-basins which drain to the Atlantic. These are the basins of the Orinoco in the north, the Amazon in the centre, and La Plata (or the Plate) in the south. Those of the Orinoco and the Amazon surround the north-eastern highlands except on the seaward side : the divide between the two basins is so low and so imperfectly marked that there is a waterway, called the Cassiquiare, which actually connects the upper Orinoco with the Negro, a tributary of the Amazon. La Plata, it should be noticed, is the name of an estuary only, like the Humber in England : we shall look presently for the rivers which enter it.

*The Andes.*—The mountain-system of the Andes is a vast broad ridge from which rise many peaks and ranges : its highest mountain (Aconcagua) rises over 23,000 ft. above sea-level. The Andes are about 4,400 miles long, and their average height is 13,000 ft. The system follows the line of the west coast closely, for the coastal lowland, where there is any, does not average more than 40 miles in width. And the steep western slope of the mountains is continued beneath the sea, which is very deep close off shore throughout most of the length of the west coast. Here, then, is a sharp fold in the crust of the earth, from the ocean floor to the top of the mountain-system. These high mountains are ‘ young ’ in comparison with the highlands of the east, which are worn down to plateau form and to much lower elevation ; just as the Rocky system of western North America is young in comparison with the eastern highlands of that continent. And along these ‘ young ’ sharp folds active volcanoes are still found at some points—Cotopaxi, 19,600 ft. high, nearly on the Equator, is the highest volcano in the world—and severe earthquakes sometimes occur, whereas in the older eastern highlands there are no volcanoes, and earthquakes are almost unknown.<sup>1</sup>

In the north the Andes has three main chains, between which lie valleys drained northward by the river Magdalena and tributaries. Farther south there are generally two main chains. The Spanish

<sup>1</sup> See Part II, p. 434

word for a mountain-system, *cordillera*, is in common use here as elsewhere, and in some parts the western chain is called simply the Cordillera as distinct from the eastern which is called the Andes. A deep depression lies between the main chains, and is occupied in some parts by basins of inland drainage, such as that of Lake Titicaca about  $15^{\circ}$  S. lat. This deep lake, 12,750 ft. above sea-level and 5,000 sq. miles in area, has an outflow into a marsh, but not, so far as is known, to the sea. A broken chain of hills, called the Cordillera de la Costa because it fringes the coast, breaks the coastal lowland, and south of lat.  $40^{\circ}$  S. it becomes a chain of high, steep islands,

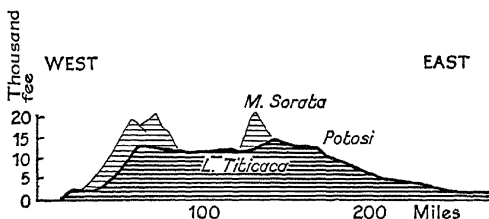


FIG. 110. SECTION OF THE ANDES about lat.  $16^{\circ}$  S.

separated by deep channels and fiords which penetrate far into the mountains: we may compare, in the southern hemisphere, the south-west coast of New Zealand. At the southern end of the continent the Straits of Magellan cut through from the Pacific to the Atlantic Ocean, and separate from the mainland the wild island of Tierra del Fuego, south of which, on a smaller island, is Cape Horn, regarded as the southern end of the continent, and notorious for the stormy west winds and seas which sailors have to expect when rounding it. The snow-line on the Andes is found at about 16,500 ft. on the Equator, down to less than 5,000 ft. in Tierra del Fuego, where the mountains themselves do not much exceed 7,000 ft. There are glaciers, though small ones, even at the Equator; but at the Straits of Magellan some of them reach right down to the sea. It may be supposed that in this mighty mountain-system there is some of the finest scenery in the world, and extending as it does through nearly two-thirds of the southern hemisphere in latitude, it provides examples of mountain-lands under every climatic condition from

equatorial to sub-arctic. The northern part of the west coastal belt, southward to about  $5^{\circ}$  S., has rich tropical vegetation ; then it becomes sandy and dry to  $30^{\circ}$  S. lat., and includes the desert of Atacama (with which may be compared the desert of south-west Africa : we shall return to this point presently). Across the dry belt streams flow from the mountains and maintain narrow fertile valleys ; but many of the streams run dry and do not reach the sea.

*The Lowlands : Amazon and Orinoco.*—The eastward slopes of the Andes toward the plains are generally less steep than the western. Among the rivers which drain the plains, the Amazon is the largest in the world. Its basin is often compared with that of the Congo, in Africa, which flows into the Atlantic nearly opposite to it. A comparison of maps will suggest points of contrast. The Congo basin, for example, is more clearly marked out than the Amazon basin, especially on the north, where Amazon and Orinoco waters are connected. But the most striking contrast lies in the fact that whereas the Congo descends in falls from the African plateau not far above its mouth, and has rapids at intervals higher up (p. 255), the Amazon falls only 300 ft. in 1,700 miles above its mouth, and can be navigated that far by large sea-going ships. Altogether it is navigable for 3,000 miles, practically up to the eastern base of the Andes, in which it rises. Through tributaries it drains waters not only from these mountains but also from the eastern and north-eastern highlands. Many of the tributaries are navigable for long distances, but the greater part of the basin is covered with dense tropical forest, sparsely inhabited except at a few points, and much of it is very little known—less so even than the Congo basin, with which, in these respects, it compares. The course of the Amazon over the plain is hardly ever within a single channel ; it wanders in many channels between low islands, and at some points in its lower course it is so wide that one bank cannot be seen from the other. It is flanked by marshy lands, densely forested, save where, rarely, a low flat-topped hill rises near the river. The Orinoco rises in the north-eastern highlands and flows round them northward and eastward ; but its western tributaries come from the Andes. The quantity of silt brought down by these rivers is so great that, in the case of the Amazon, the sea is discoloured for 200 miles from the

shore, and owing to the great volume of fresh water discharged the salinity (saltness) of the sea hereabouts is low.

*La Plata.*—The rivers of La Plata or the Plate estuary, similarly, drain both the Andean slopes and the southern slopes of the eastern highlands. The rivers Paraná, Uruguay, and Paraguay enter La Plata estuary. The Paraguay rises on the plateau of Matto Grosso (the south-western edge of the Brazil Highlands) and flows southward. At the town of Asuncion it is joined by the Pilcomayo river which has its source on the Bolivian plateau of the Andes. Some 200 miles south of this junction it meets the Paraná river. This river, which rises in the Serra do Paraná, has cut out a broad valley in the Brazil highlands roughly parallel to the east coast. Along the course are found a number of falls made by the river as it descends from this highland region. The Uruguay rises very near the east coast in the Serra Geral, flows westward to within a hundred miles of the Paraná, and then turns southward to flow to the Plate estuary. In many parts, especially along the Paraná in its upper course, these rivers are liable to flood, and large swamps are found.

South of the Plate estuary some considerable rivers reach the Atlantic from the Andes, but beyond lat.  $40^{\circ}$  S. there are few, as the eastern slope of the continent, in the country known as Patagonia, is dry.

*The Eastern Highlands.*—The northern and north-eastern coast of South America, as far as the mouth of the Amazon, is generally low, often marshy, and, like most of such tropical coasts, thickly covered with vegetation. The northern coast is broken by the deep Gulf of Venezuela (‘little Venice’, so called because an early explorer saw native dwellings rising out of the water, and was reminded of the city of Venice in Italy, which is built on islands in a lagoon). Behind the low coastal belt rise the north-eastern or Guiana highlands, a tableland with wide flat summits reaching, at the most, nearly 9,000 ft. Its flanks are thickly forested and difficult to come at, so that few travellers have seen (for instance) the Kaieteur Falls, one of the most magnificent waterfalls known. But within the highland region there are also wide open plains. The eastern or Brazilian highlands reach an extreme height of nearly 10,000 ft. Southward from the mouth of the Amazon these highlands rise, at many points,

directly from the shore, so that the coast is bold and beautiful, the rocks being often brightly coloured. From Cape St. Roque, near which the continent reaches its easternmost point, southward nearly to lat.  $20^{\circ}$  S., there are many coral reefs, and also reefs of rock which protect the inlets of the coast and form natural ports, among which that of Pernambuco may be noticed. On either side of the tropic of Capricorn, from about  $20^{\circ}$  to  $30^{\circ}$  S., the mountains of the Serra do Mar rise steeply from the sea, and make this the most beautiful part of the eastern coast. There are several natural harbours, formed

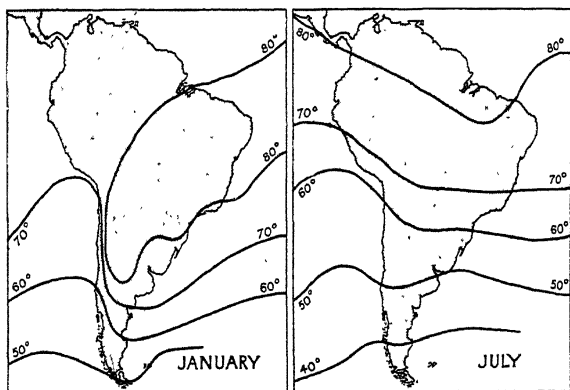


FIG. 111. ISOTHERMS (temperatures reduced to sea-level).

by the 'drowning' of coastal valleys: that of Rio de Janeiro (Rio for short) is one of the finest in the world. The coast southward from  $30^{\circ}$  S., past the Plate estuary and as far as the Straits of Magellan, is flat and sandy, or rocky where the stony plains of Patagonia extend behind it.

*Climate.*—South America has its widest extent in low latitudes; therefore the climate over a very large part of the continent is hot. The land narrows toward high latitudes; therefore there is no region with an extreme climate of 'continental' type, as in the north of North America, which is broadest in high latitudes. The Andes form a climatic barrier between the west coastal belt and the rest of the continent, and on account of their height they have their own climatic divisions. In the north a hot belt extends from sea-level

to about 3,000 ft., a warm temperate belt to 6,000, and a cool belt to 10,000; the highlands above this up to the permanent snows are too cold for cultivation and tree growth. In the cool belt on the Equator there is a climate sometimes compared to a perpetual spring, though not always a pleasant one: at the city of Quito (9,300 ft.) the mean temperature of the hottest months is 55° F. and that of the coolest month not one degree less; but the daily range of temperature is large, from cold nights to hot middays, and clear mornings are commonly succeeded, as elsewhere in the equatorial region, by heavy clouds, rain, and thunder.

The apparent movement of the sun is followed by rainfall conditions not unlike those we noticed in tropical Africa so far as concerns the seasons. In the equatorial region, and therefore over the Amazon basin, so far as is known, excepting the southern part of it, there is rain at all seasons, with two periods of heaviest rain. The north-east and south-east trade winds blow freely over the low Amazon lands until they are checked against the eastern face of the Andes, where it appears that they drop still heavier rains. The Amazon basin includes the most extensive area in the world which has so heavy a rainfall, ranging from 80 to 150 in. or more in the year; it contrasts in this respect with the Congo basin, which is less open to wet winds. Again we find the common equatorial type of rain and thunder-storms in the afternoon following a clear morning; in some places so regularly that 'before the rain' and 'after the rain' become expressions used to tell the time of day. The Guiana (north-east) coast, backed by the north-eastern highlands, is excessively wet; its features of high temperature, humidity of the air, and low damp land may be compared with those of the coastlands of the Gulf of Guinea in west Africa, and are equally hard for white men to bear. In the extreme north of the continent, and over a wide area south of the region of rain at all seasons, extending as far as the latitude of the Plate estuary, rainfall is mainly or entirely in summer, when the sun is most nearly overhead. This rainy season in summer is sometimes called 'winter' by the people: the Spanish language is used and the people who use it are largely descended from Spaniards; perhaps the winter rainy season of the Mediterranean region was remembered by the original settlers and they supposed that any rainy season must be winter. From the

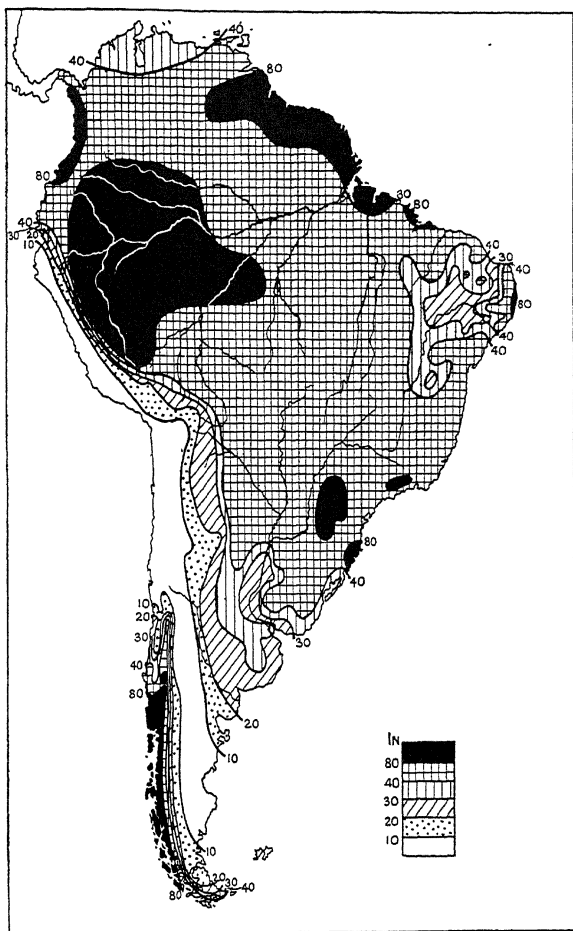


FIG. 112. MEAN ANNUAL RAINFALL OF SOUTH AMERICA.

mouth of the Amazon to the easternmost point of the continent there is a region along the coast which has a relatively small rainfall, mostly in autumn or even winter, the reason for which is not clear. The east coastlands from the tropic south to lat.  $40^{\circ}$  have rain at all



seasons. The interior of the eastern highlands, and of the northern plains of the Plate basin, are in some parts very dry, and the rains may even fail altogether. About the Plate estuary the *pampero* squall, as a depression is passing away, is characteristic, raising dust-storms on the plains and making danger for shipping: it may be compared with the Australian Southerly Buster. The south of the continent extends into the region of the Roaring Forties. We have noticed already, and every one who has read books of the sea will remember, the stormy waters off Cape Horn, one of the wildest tracts of ocean in the world. The Andes, lower in the south, do not form a complete climatic barrier here, but the westerly winds, leaving most of their moisture on the western face, pass nearly dry over the eastern land of Patagonia, much of which is arid.

The north-west coast of South America is very hot and wet. At the Gulf of Guayaquil, an easy point to bear in mind, there is a rather sudden change to cooler and drier conditions. Farther south, a cold ocean current called the Humboldt current, to be compared with the Benguella current in the south Atlantic, flows northward along the coast, and as the southerly winds drive off the warmer surface water, cold water takes its place from beneath. Temperature maps show the isotherms bending northward hereabouts, as the temperature of the adjoining coasts is cooler than the normal. Cloud and fog are common all along this coast, and the beauties of the mountain-lands as viewed from the sea are all too commonly hidden. As far south as lat.  $30^{\circ}$  the prevailing winds blow nearly parallel to the coast; they are not moist, having passed over cold seas toward warmer land so that their relative humidity is reduced; the coastal belt itself is sheltered by the coast ranges of hills, and so this belt is dry, and in great part, as we have seen, actually desert. Southward again to lat.  $40^{\circ}$  S. (these South American latitudes are particularly easy to remember) we have the region where the westerly wind-belt of the Roaring Forties, following the sun, reaches its most northerly extension in winter, which therefore is the rainy season. This with the mild temperature gives the valley between the coastal range and the Andes, and the lower western slopes of the Andes themselves, a climate of Mediterranean type, with which we may compare that of California, and also those of the Cape of Good Hope and of south and south-west Australia—

noting that the southward extension of Africa and Australia is only just sufficient to reach this belt. South of lat.  $40^{\circ}$  S., we have seen that the west coast is under the full influence of the westerly winds.

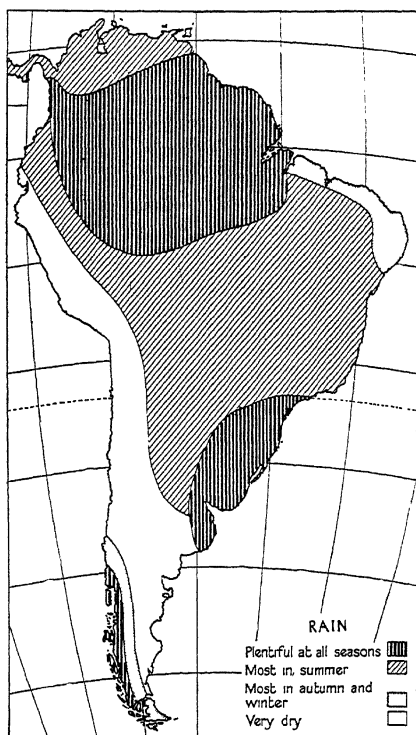


FIG. 113. SEASONAL RAINFALL IN SOUTH AMERICA.

*Vegetation.*—Along with the heavy rain and high temperature of the lowlands in the equatorial region, we find in South America, as elsewhere, dense tropical forest. It extends along the west coastlands from the Gulf of Guayaquil northward, and around the north and east nearly as far as the tropic of Capricorn. It broadens over the Amazon basin, so that this huge lowland contains the greatest extent

of hot moist forest in the world. Marshes fringe the rivers, something like the mangrove swamps of low tropical sea-coasts, with vegetation so dense that men can only get through it with great difficulty, if at all. Behind them stretches the forest of innumerable different trees and plants, some of them, such as those which yield rubber, fine woods, and Brazil nuts, valuable to man, but difficult to come by because of the oppressive climate, the density of the forests, and the fewness of the inhabitants. These Amazonian forests are called *selvas*, and, from them, the term is sometimes used of other tropical forests. In the regions north and south of the central Amazon basin, where the rainfall becomes more markedly seasonal and decreases away from the coastlands, and also where the land lies generally higher, there are large areas of savanna. They may be compared with those north and south of the Congo forests in Africa; but there is no savanna west of the Amazon as there is east of the Congo basin, on account of the high barrier of the Andes, narrow in comparison with the eastern highland region of Africa. Immense areas of gently undulating country are seen, of the parkland type, with tracts of tall grass interrupted in the valleys by open woods, both on the Guiana tableland and over the south-east of the Amazon basin. They are called *campos*; and the Guiana campos sink westward to the *llanos*, low grassy plains, of the Orinoco basin. The rivers are commonly fringed with thick forest. The grasses of the plains, where there is a long dry season, become parched and brown then, but flourish richly during the rains. The dry interior of the eastern highlands has nasty tracts of thornyscrub. The interior of the Plate basin, where it is crossed by the tropic, is partly a forest region, but is less hot and wet than the Amazon basin, so that the forest is less heavy and the trees less varied. On higher ground to the east of the region the woods consist largely of beautiful pines (*araucaria*), and beneath them flourishes a tall bush of which the leaves and twigs are dried and used to make a drink, called *maté*, just as tea is made from the dried leaves of the tea shrub. The low land in the north-west of the Plate basin is called the Gran Chaco.

South and south-west of this region, in a half-circle whose centre is in the Plate estuary, the flat plain called *pampa* ('the space'), extends from the east coast to the foot of the Andes. We shall presently find this plain, with its deep soil and fine grass, to be

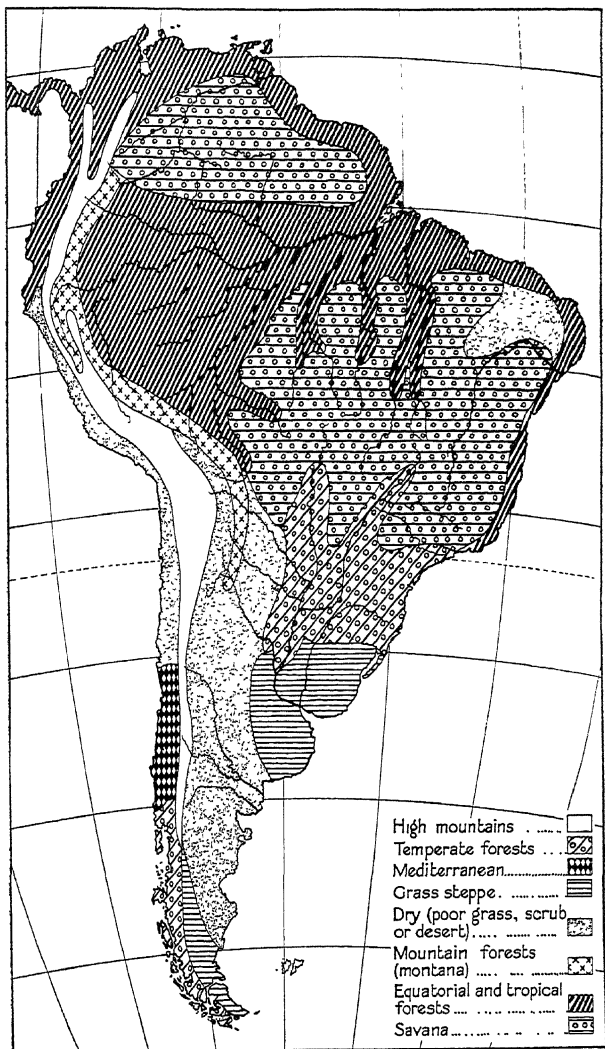


FIG. 114. NATURAL VEGETATION OF SOUTH AMERICA.

one of the most important regions in the economic geography of South America; for it is one of those regions of the world, like the North American central plains, from which wheat and meat are exported on a large scale to feed more populous regions in the temperate lands. West and south of the *pampa*, where rainfall under the shadow of the Andes is small, the land is dry and the vegetation scanty and scrubby; only in the narrow southernmost part of the continent, where the mountains are lower, does the eastern side get enough rain to grow good pasture.

The Andes, owing to their immense length and height, have been said 'to summarize the vegetations of the whole world'.<sup>1</sup> From north of the Equator to the tropic, the eastern slopes, receiving heavy rain, are covered with forest in the region known as the *montaña*; the vegetation is tropical on the lower slopes, temperate above; while higher again there are alpine shrubs and grass-lands. Many of the trees of the higher, temperate slopes in tropical latitudes are unlike those of temperate lands, as in Europe. There should be noticed the cinchona, which yields quinine, a drug so valuable, especially in hot lands where white men are liable to fevers, that it has been introduced into some of them. Farther south, the eastern slopes are dry like the plains at their feet, until in the extreme south there are temperate forests (such as beech). The western slopes range from tropical forests, mainly of the less heavy sort, through the western desert conditions, to the evergreen mediterranean type of vegetation accompanying the climate of that type, replaced in the extreme south by conifers and beeches. The high Andean plateaus about and north of the Equator, with a climate, as we have seen, rendered temperate by their elevation, have temperate vegetation also. The drier plateaus (*punas*) farther south, where the areas of inland drainage are, behind the western desert, bear thin grass at the best, and are treeless. As commonly in dry inland drainage areas there are tracts of alkaline salt marsh, called *salinas*.

*Animals*.—No part of South America is a home of big game, as parts of Africa are, nor are wild animals so numerous. The biggest flying-bird in the world, the condor, lives among the high Andes. The boa-constrictor is a huge snake. But with these well-known exceptions and a few others the animals are not generally large. Llamas

<sup>1</sup> Hardy's *Introduction to Plant Geography* (Oxford).

and alpacas are animals familiar to the mountains, protected by woolly coats against the cold of the heights ; their wool is of value to man, and the llama is domesticated as a beast of burden to carry at least light loads. The chinchilla has a valuable fur. On some parts of the grass-lands, especially the llanos, there are many wild cattle, apparently descendants of those escaped from captivity. On the southern plains of Argentina the rhea, something like the South African ostrich, is found. South America contains, we shall find, some of the most important pasture-lands (for cattle and sheep) in the world.

*Political Division.*—The political geography of South America differs from that of the other southern continents (and, for that matter, of the northern continents). It is not divided between European nations as most of Africa is, nor is it a dominion of a single European people, as Australia is British. Nor, again, has it any purely native states remaining, as Africa has. The only South American colonies belonging to European powers are in Guiana, which is divided into British, Dutch, and French Guiana, colonies of the tropical type unfit for settlement by large numbers of white men, but administered by a few of them.

The rest of the continent is divided between ten republics. In the north, Venezuela covers a large part of the Orinoco basin, including the mouth of the river. To the south-east of it lie the Guiana colonies, extending inland from the tropical coast to the plateau of the north-eastern highlands. South of these territories, Brazil covers most of the Amazon basin and of the eastern highlands : it is by far the most extensive South American state, but, in the Amazon basin especially, it includes huge areas sparsely inhabited if at all, and in large part little known, or unknown. In the south it reaches the upper part of the Plate basin, but the small inland territory of Paraguay intervenes between it and the junction of the Paraná and Paraguay rivers. The extreme south of Brazil has its frontier with Uruguay, which borders the north shore of the Plate estuary, important as the principal sea entrance to the south-east part of the continent. This part, for the rest, is occupied by Argentina, within whose territory fall the rich agricultural and pastoral *pampa* lands. The western republics are confined mainly to the Andean region ; with one exception, they border the west coast and their commerce

passes through western ports, and so far as their territories cross the Andes into the Orinoco and Amazon basins, it is into country little developed or even known. Colombia in the north-west borders the territory of Panama, where the isthmus of that name joins South to Central America ; Colombia, therefore, has a coast-line on the Atlantic (Caribbean Sea) as well as the Pacific, and its chief natural highway, the river Magdalena, opens to the Atlantic. Farther south Ecuador, as its name signifies, lies on the Equator. Peru lies south again, and includes the Andean head-streams of the Amazon. To the south-east of this, the republic of Bolivia is wholly inland, for the west coast, where its sea-outlet naturally lies, is shared between Peru and Chile. Chile is a territory of strange shape, for it extends 2,700 miles to the extreme south of the continent, but includes only the western face of the Andes and the narrow coastal belt, so that its breadth is never more than 230 miles, and generally much less.

*Population.*—These republics are descended from Spanish and Portuguese colonies, since Spain and Portugal no longer hold as overseas possessions the South American territories which their early voyagers originally explored. Portuguese in Brazil, Spanish in the other republics, remain the official languages, and a proportion of the inhabitants in each are of mixed blood, Spanish or Portuguese with native Indian. The Indians vary in character ; some are industrious, good cultivators, and skilled in boat-building and other simple arts ; others (more generally) are lazy and low in the scale of civilization, down to those who, almost if not quite uncontrolled by the governments of the territories they inhabit, live purely savage lives, such as the Amazonian tribes who hunt in the tropical forests with blowpipes and poisoned arrows, or the wild Fuegians who live under the hard conditions of Tierra del Fuego. In some of the republics which are least advanced in trade, Indians form most of the population, as in Bolivia, Ecuador, Paraguay, and Peru. In these, about a quarter of the population is of mixed blood, and forms, in effect, most of the fully civilized population. In Chile, a more advanced state, the mixed white population is much more numerous in proportion to the Indians : here is more territory better suited for Europeans as to climate and other physical conditions, than in the states previously mentioned. In Argentina and parts of southern Brazil, as well as central Chile we find the lands most suitable for

settlement by white men. They may be compared with South Africa, which although nearer the Equator is also higher, so that the temperature conditions are not unlike. In Argentina particularly the population is of varied origin ; among the European immigrants there are Italians, Spaniards, Russians, French, Austrians, Hungarians, British, and Germans ; among others, there are some Turks.



FIG. 115. The parts of South America where the population is densest (shown in black) and scantiest (in white).

In Argentina and Brazil it is to be noted that the Italian immigrants, though numerous, do not all stay in the country : many, after making money, return to Italy. The love of their own beautiful land is very strong among Italians. British emigrants have their own vast imperial territories to choose from, so that their numbers in South America are not large ; but in South American commerce, especially Argentine and Chilean, British interests are strong. Among other non-native peoples in South America, there are the negroes, principally in the hot northern lands (Guiana, Venezuela, Colombia).



Negroes, as in the United States, were brought in originally as slaves : in the South American countries they are not usually, as free men, of high standing among the population. In British Guiana there is a large number of Asiatic Indians (East Indians they are termed here, in distinction from the native Indians, so-called) ; they were recruited as labourers in this hot land where white men cannot do hard labour, and natives are few, and of little service. Along the west coast of the continent there are some Chinese.

#### SOUTH AMERICAN TERRITORIES : ECONOMIC CONDITIONS

*Venezuela* is divided as to surface between the low coastlands and llanos or savannas of the Orinoco basin, a part of the Guiana highlands in the south, and in the west a chain of the Andes, which continues as a broken highland parallel and near to the north coast. It thus has agricultural, pastoral, and forest lands. They are not at all fully developed, but coffee and cocoa, cattle and hides are among the chief exports, while the most important of the forest products is balata, which resembles rubber. Minerals are rich ; gold is that principally mined ; among others, some coal and petroleum are worked. There is a pearl fishery off the north coast. Railways amount only to a few hundred miles, but there is over 11,000 miles of river navigation, and good roads are developing in accordance with the modern development of road transport in lands where railways have not been built extensively. The capital is Caracas, six miles inland in a direct line from its port La Guaira, but the railway connecting the two is over twenty miles long and must climb a pass over 5,000 ft. high.

*Guiana*.—British Guiana, a colony difficult to develop, as its position and natural features suggest, yields mineral wealth which includes gold, diamonds, and bauxite (from which aluminium is produced). Sugar, rum, and balata are among other exports. The capital is the port of Georgetown, called also Demerara from the river on which it stands. Dutch Guiana, or Surinam, exports principally sugar, rum, cocoa, and coffee ; and in French Guiana gold and phosphates are worked, cocoa is cultivated, and the forests yield balata and various woods.

*Brazil* is the largest of the South American republics, having an area of more than 3,000,000 sq. miles—not far short of half that of

the continent. As we have seen, however, vast tracts, especially in the Amazon basin, are little, if at all, developed. The Amazon river provides good waterways, and, with the upper Paraná, gives some 17,000 miles of navigable waterways which have regular services ; but, in all, such waterways must amount to at least double that length. The resources of Brazil are varied : the most prominent is coffee. This is grown in the sub-tropical territory of the south-

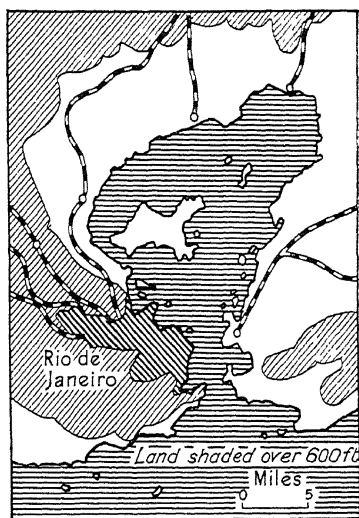


FIG. 116. THE POSITION OF RIO DE JANEIRO.

east, on the slopes of the eastern highlands, and usually at a height of 1,000 to 4,000 ft. Along the coast here, south of the easternmost point of the continent, we find the most populous and prosperous parts of the republic, and most of the chief towns. Rubber-yielding trees grow in the hot Amazonian forests, and some rubber is got from plantations. Other important products of the hot region are cocoa, nuts, vegetable oils, and various timbers, and cotton cultivation is promising. Pará, however, the chief port of this region, is best known for its connexion with the rubber trade. A thousand miles up the Amazon, where it is joined by a huge tributary, the Negro, the

town of Manaos forms a collecting centre for forest produce. Steamers of 7,000 tons can reach Manaos from the sea.

Rio (de Janeiro) is the capital, on a fine natural harbour backed by beautiful high hills, steep and bold, and giving access to a fertile district. Santos and São Paulo are towns closely connected with the coffee trade ; Pernambuco with that in sugar ; Bahia with those in cocoa and tobacco, among others. Cattle-rearing becomes important in the south, where, as we shall find, other states within the Plate basin are also noted for it. Hides and chilled meat are exported : meat-packing is a big industry of São Paulo. Mineral fields are worked at several points in the east, and gold, iron, manganese, and diamonds are procured ; while monazite sand, from which is obtained thorium, used in the making of gas mantles, is a special product of Brazil. Manufactures of some importance, as of woollen and jute goods, foods, and sugar, have developed principally in the district of Rio. Railway development, on the whole, is backward, except in the Rio and São Paulo districts ; the ascent from the ports up to the eastern highlands has made railway-building difficult.

*Uruguay*, the smallest of the South American republics, has for the most part a rolling surface of no great height, on the southern edge of the eastern (Brazilian) highlands. It borders the Plate estuary on the north, and its capital and chief port, Montevideo, is one of the biggest cities in South America and the converging-point of a fairly extensive railway system. The river Uruguay is navigable, from the estuary, along the western boundary. The country's chief wealth is in cattle and sheep ; its exports of meat, hides, and wool are valuable, and its meat-packing industry large: Paysandu and Fray Bentos, centres for this industry, are well known in Britain and many other parts of the world for their products.

*Paraguay*, another of the smaller republics, extends from the south-western edge of the eastern highlands, across the Paraguay river to the Gran Chaco. Much is forested, especially in the west, but grass-lands also are extensive, and here, again, cattle-raising is the leading industry ; sheep also increase in number. Some half the exports consist of meat, hides, and tallow ; other products are maté, sugar, tobacco, and cotton. Asuncion on the Paraguay river is the capital ; it is over 900 miles above Buenos Aires on the Plate estuary. Railways are not well developed in this inland territory.

*Argentina*, the south-eastern republic, includes, as we have seen, the temperate lowland region of the pampas which is economically the most important region in South America. It provides great crops of cereals and affords pasture for immense herds of cattle and flocks of sheep. The soil is fertile and easily cultivated. The chief crop is wheat, and the area for this extends gradually. It is limited in the north by excess of heat and moisture, and in the west and south by lack of moisture ; but in the south it has been extended by irrigation. Maize is grown to the east of the wheat-lands, chiefly along the river Paraná. Another valuable crop is flax, grown in the same part as maize, and the seed (linseed) is exported largely. For grazing, big tracts are planted with alfalfa, a plant belonging to the clover family. Sheep are reared on the poorer pastures and in the drier parts, both for their wool and for their mutton ; but more beef than mutton is exported. Britain draws large supplies of frozen and chilled meat, as well as wheat, from Argentina. Important industries are meat-packing, the preparation of meat extracts, and the manufacture of soap, candles, and oils. Hides support a leather industry, and are exported. Flour-milling is an extending industry, as also are dairy industries, and various manufactures such as might be expected in this temperate land of modern development. In the warmer territories of the north and west, tobacco, cotton, and hemp are grown, and wine is made from the vines cultivated among the Andean foothills. The richest parts of the pampas—southward to about 40° S. lat.—have by far the most extensive railway system in South America. They centre principally upon the capital, Buenos Aires, which is among the greatest cities in the New World, with a population not far short of two millions. It stands on the south shore of the Plate estuary, the importance of which as a seaway will be now fully understood—although it is not naturally good, and needs constant dredging, for the muddy water is shallow, and the tidal movement, which might help to keep the channel clear, is small.

Here in Argentina we find, then, one of the four big examples of newly-developing temperate lands in the southern hemisphere : the other three are found in South Africa, Australia, and New Zealand ; and instructive comparisons can be made between them.

*Colombia*.—We return now to the north, to consider the western states which have their territory principally in the Andean region.

Colombia has tropical coastlands with cultivation of bananas, cotton, sugar, and tobacco, and coffee on the lower mountain-slopes. There are also large areas of grass-land fit for cattle. The mineral wealth is great. Gold and platinum are the metals chiefly worked, and Colombia supplies a very large proportion of the world's supply of emeralds. Coffee, bananas, and hides are among chief exports. Communications are not easy, and much good land is undeveloped. The river Magdalena forms a main inland waterway, with railways, so to say, tributary to it, and skirting its unnavigable parts. The capital, Bogotá, stands high on the interior range of the Andes. The manufacture of Panama hats (so called) has extended from Ecuador.

*Ecuador*, in somewhat the same way, yields tropical products from the low coastal strip and lower valleys of the mountains; in the higher valleys temperate fruits and grains are grown. Cocoa is the main crop (from the hot lands) for export; a product of the hot forests is the ivory nut; among other leading exports are coffee and cotton; and the manufacture of Panama hats, mentioned above, has its chief centre in Ecuador. Petroleum is worked. The capital, Quito, high among the mountains, is served by a railway climbing from the port of Guayaquil.

*Peru*, again, has a low coastal strip, a highland area among the mountains (sierra), and vast tracts of forests in the *montaña* (p. 350). Sugar and cotton are leading agricultural, petroleum and copper leading mineral, products. The wool of sheep, alpacas, and llamas from the high pastures; cinchona (for quinine) and coca (for cocaine) from the *montaña* forests; guano from deposits on coastal islands, are also to be noticed. Lima, the capital, lies low, and close to its port of Callao.

*Bolivia*, the third largest state in South America, has no coast-line; there are vast tracts of mountains and forested lands very sparsely inhabited; and in spite of river communication eastward to the Plate estuary and rail connexion westward with Mollendo (a Peruvian port), the channels for trade are difficult. Nevertheless, Bolivia is one of the richest mineral countries in the New World, and for the production of tin it is one of the principal in the whole world. It has famous silver and copper mines also. Rubber is obtained from the hot forests, and cinchona and coca as in Peru; while the usual tropical cultivations are carried on to a small extent. The chief

towns stand on the Andean plateau at heights of 9,000 ft. or more ; La Paz, the largest, is at a height of 12,700 ft.

*Chile* includes, in the north, the Atacama desert division (p. 341) ; in the centre, the division where climatic conditions and vegetation are mainly of mediterranean type (p. 346) ; and in the south, the forested division with the island-fringed coast (p. 340). The dry northern division, unlike most desert regions, is of great value, for immense deposits of nitrate of soda are worked here, in the face of overcoming great difficulties in getting water. It is due to the absence of rain that these deposits have been preserved in the soil. They are of value as a fertilizer and for various manufactures, and form by far the largest export from Chile. They are exported from the ports of Iquique, Antofagasta, and others, and the ships which carry them can bring back coal, in which Chile is not rich. Among other minerals in Chile copper is of considerable importance. In the long longitudinal valley (the Great Valley) of the central division, and on adjoining slopes, the vine, maize, wheat, and various fruits flourish in the ' mediterranean ' climate. The southern forests are difficult of access and hardly developed, but in the interior, on the eastern Andean slopes (as in the Patagonian territory of Argentina) there is fair grazing, especially for sheep, and the port of Punta Arenas on Magellan Strait has a trade in wool. The capital, Santiago, stands in the ' mediterranean ' region inland from the chief port of Valparaiso : both are connected, by the only transcontinental railway in South America, with Buenos Aires and the Argentine railway system generally. The line crosses the Andes by a pass which is 12,870 ft. high. The Great Valley in Chile offers fairly easy communication north and south, and railways run along it and connect it with ports through gaps in the coastal hills.

*The Falkland Islands*, a small British colony, lie east of the Straits of Magellan, in the South Atlantic Ocean. Sheep-farming is the chief occupation. The colony includes antarctic island-groups far to the south-east and south ; there is a whaling settlement in South Georgia.

## EXERCISES

1. Divide South America into its chief physical divisions and briefly describe the main features of each.

2. Compare the chief climatic divisions of South America with those of Africa.

3. Explain how the climatic and physical conditions have influenced the economic development of any of the South American states.

4. Give an account of the climate and surface features of the following: Pampas, Selvas, Montaña, Campos, Llanos. What are the productions of each?

5. Describe and account for the position of the Atacama desert. Give the names of the ports of this region and the trade passing through them.

6. Give reasons for the relatively small population of South America, and describe its distribution with special reference to the influence of relief and climate.

7. Give an account of the coffee-growing industry of Brazil.

8. Divide Chile into climatic regions, and show how the climate influences the economic development of each region.

9. Draw a map of the Argentine Republic. Insert the chief river systems, the main railway lines (with the Trans-Andean railway), and the position of the chief towns. Indicate the desert regions, and show the corn-growing districts.

10. Write an account of the climate and surface features of the Guianas, and give the products and towns of one of them.

11. Write an account of the physical features and climate of one of the following: Venezuela, Peru, Ecuador. Show how these factors have influenced the life and occupations of the inhabitants.

12. Draw a map of the Amazon basin. Describe the economic conditions of the region, and compare them with those of the Congo basin.

13. Account for the comparatively rapid development of the Argentine republic. Name the chief products and the districts producing them, and give an account of the export trade.

14. Describe the position; and account for the importance of the following towns: Manaos, Quito, Para, Georgetown, Santiago, Montevideo, Rio de Janeiro, Valparaiso.

15. Draw a diagram (or map) to show the position of the principal winds of South America. Describe the seasonal changes which take place in the position of these belts.

16. Where and under what conditions are the following produced in South America—rubber, cinchona, cotton, sugar, vines, tobacco ?

17. Compare and contrast the basin of the rivers flowing into the Rio de la Plata with that of the Mississippi, and the Amazon with the St. Lawrence.

18. Draw a map to show the river and railway communications of South America other than those of Argentina.

19. In the surface relief of South America and Africa, what are the main contrasts and resemblances between the two continents ?



## X. AUSTRALIA, NEW ZEALAND, AND THE PACIFIC

THE name Australasia is given loosely to the great area of sea and land which contains Australia, New Zealand, and a large number of other islands. Though not a single land-mass it is sometimes spoken of as a continent ; but so also is Australia alone, and some people object to using the name Australasia to cover a whole region in which some of the countries are separated both politically and by wide distances of ocean. There is, however, between the Malay Archipelago and Australia in the west, and New Zealand, the Tonga and other Pacific islands in the east, a vast area of the ocean-floor, from which these lands rise, where the sea is not so deep as the waters surrounding the region on the north, east, and south.

### AUSTRALIA

*Outline and Surface.*—Australia, politically a commonwealth in the British Empire, is the smallest continent, being more than three-quarters the size of Europe. It is simple in form, and compact. It is, for the most part, of plateau form, and has neither very high mountains nor much broken coast. One great gulf, the Gulf of Carpentaria, breaks the north coast ; two smaller gulfs, Spencer's and St. Vincent's, break the south coast, which also, to the west of these, sweeps inward in a wide curve to form the Great Australian Bight. A line drawn north and south between Carpentaria and the southern gulfs passes over little land which is more than 1,000 ft. above sea-level, and the greater part is less than 600 ft. This area may be called the central lowlands. East of these, a wide belt of higher land extends north and south, and more or less closely borders the east coast. This belt forms the eastern highlands, which are continued to the south in the island of Tasmania : this island rises from the continental shelf of Australia. West of the central lowlands there is a great expanse of land lying above 600 ft., with a few higher ranges of hills, and bordered by narrow lowlands round the head of the Great Australian Bight and the west coast. This may be called the western tableland.

'The eastern highlands are made up of a great number of ranges. In the north hills over 3,000 ft. high rise close to the east coast, so

that there are no long rivers on that side, but several flow west to the Gulf of Carpentaria. Farther south, in central Queensland,<sup>1</sup> the highlands are mostly lower, and are broken by several large rivers flowing east. But from southern Queensland right through New South Wales the highlands are higher and less broken; heights between 5,000 and 6,000 ft. are found in the New England and Blue Mountains ranges, and there are only a few important gaps, like those of the Hunter River and Goulburn. In the south of New South Wales and in Victoria the greatest heights are found; Mount

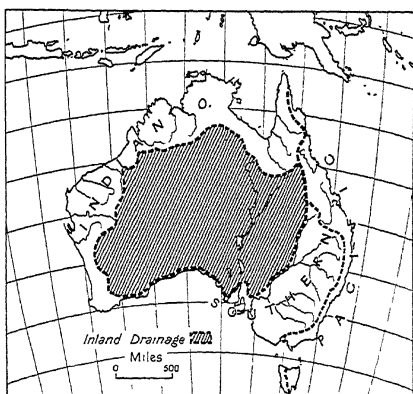


FIG. 117. OCEANIC DRAINAGE AREAS OF AUSTRALIA.

Kosciusko reaches 7,340 ft. The highest points of Tasmania are a little over 5,000 ft. Australia has little of the splendid mountain scenery of other continents; but in some parts of the south-eastern highlands bold cliffs rise above the deep valleys, and always the bare highest summits command wide views over a quietly-coloured sea of eucalyptus 'bush' (p. 368).

The central lowlands are divided into three basins: that of the Gulf of Carpentaria in the north, that of the Murray-Darling in the south-east, and that of Lake Eyre in the south-west. The divides between these basins are low, except in the south, where the Flinders (3,000 ft.) and Mount Lofty ranges (2,000 ft.) rise boldly to the east

<sup>1</sup> For the political divisions of Australia see p. 372.

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of Spencer's and St. Vincent's gulfs. The Murray-Darling basin contains the Murray, the most important Australian river, its tributary the Darling, and several other rivers tributary to these two. All rise on the western slopes of the eastern highlands, so that they have a long course to the sea, unlike the rivers which run down the short eastern slopes. The Lake Eyre basin is a dry area of inland drainage, and the lakes in it are only reached by the rivers in times of flood ; large as they look on the maps, they vary much in extent, shrinking in dry periods, and at the best they are only shallow films of water. A great part of the western tableland is also dry and has no rivers, but some large rivers flow north and west from it, and in the south-west the Swan River is important.

*The Map* of a continent so simple in construction should be easy to draw. Its central meridian,  $135^{\circ}$  E., lies just west of the Gulf of Carpentaria and Spencer's Gulf. The Tropic of Capricorn cuts east and west nearly across its centre, but the parallel  $25^{\circ}$  S. divides it more exactly. Its southernmost point is in  $39^{\circ}$  S. at the southern end of the eastern highlands, and its northernmost point (Cape York) in  $11^{\circ}$  S. at the northern end of the highlands. The length, between these points, is roughly five-sixths of the extreme breadth from east to west (which lies nearly along  $25^{\circ}$  S.); it is rather easy, in making a sketch, to reverse these proportions. Moreover, some maps of the world actually do this, on account of the distortion of shape caused by the projection used, although the area may be shown correctly.<sup>1</sup>

*Climate.*—From its latitude it would be expected that Australia, lying across the southern tropic and extending, in the north, well into the equatorial belt, would have temperatures at times very hot, and at no time very cold ; and so it is. But on the whole, mean temperatures are not so high as over other land-masses in similar latitudes, nor are the extremes of temperature so great. The surrounding seas, and the fact that there are no great heights of land, mainly account for this, and it should be easy to understand why. The extreme north, though nearest the Equator, is not the hottest part, for it projects into the sea in two large peninsulas with the deep Gulf of Carpentaria between them. Hotter than this region is one in the north-western interior, only just north of the tropic. In the south-east, the summits of Mount Kosciusko and others of the

<sup>1</sup> Compare Part II, p. 410.

eastern highlands may have wide coverings of deep snow in winter, but the lower lands have not. (Mid-winter, we recollect, is in June-July : Australia celebrates Christmas as a summer holiday.)

In summer, with the sun at the southernmost stage of its apparent movement, and with great heat in the north, tropical low-pressure systems cause monsoon winds from a northerly direction, bringing rain ; but as the sun moves northward, higher pressures follow it from the south, winds blow outward from the land, and there is a dry season. Next southward of this monsoon belt we find that of the steady south-east trade winds. These blow from the ocean on to

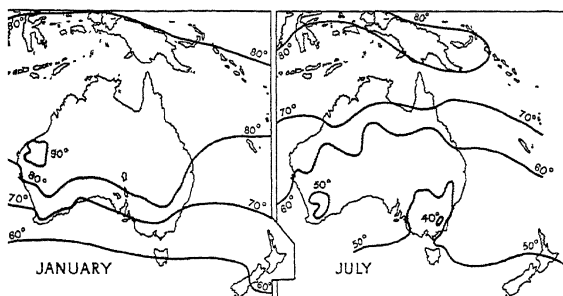


FIG. 118. ISOTHERMS (temperatures reduced to sea-level).

the steeply sloping north-east coastlands, and bring there a good deal of rain. But passing over the continent the winds soon become dry, so that much of the interior, as we shall find, is arid, and as for most of the year the prevalent winds blow outward from the middle west coast, that part of the continent is dry also. The dry region of south-west Africa (p. 265) may, to this extent, be compared. Southward again, as we know, the region of prevalent westerly winds is reached. A succession of depressions moving over the ocean south of the continent chiefly influences the rainfall of southern Australia, and brings rain mostly in winter, when the westerly wind-belt extends farthest north. The northward curve of the coast around the Great Australian Bight, however, reduces the land area which comes under the influence of these westerly winds, so that the dry centre of the continent reaches practically to the coast here, as

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also in the middle west. The northern area of summer rains and the southern area of winter rains, which do not meet in the west, overlap in the south-east, so that in eastern Victoria and southern New South Wales there is an area with rain fairly regularly distributed at all seasons.

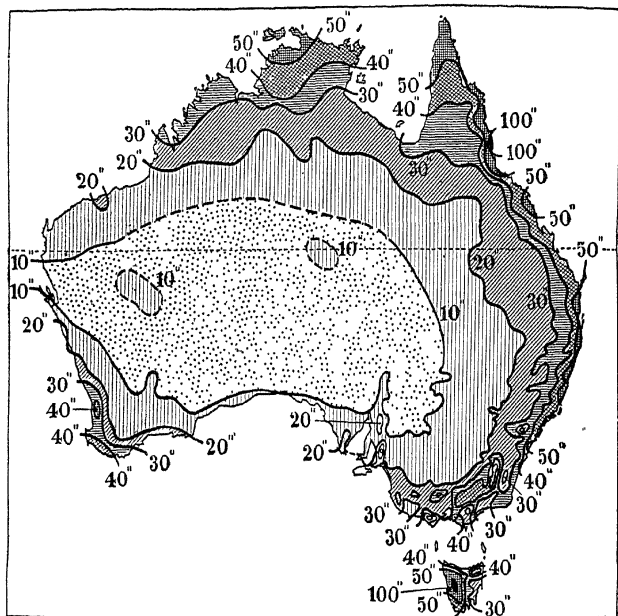


FIG. 119. MEAN ANNUAL RAINFALL OF AUSTRALIA, in inches.

Australia, then, may be divided into climatic regions as follows : (1) the northern region of the summer monsoon ; (2) the north-eastern division where the south-east trades bring heavy rains, especially in summer ; (3) the south-eastern area of rain at all seasons ; (4) the dry west-central region ; (5) the southern region of winter rains, which consists practically of two areas, in the south-west, and in the south of South Australia and western Victoria, separated by the Great Australian Bight. This is one of the typical ' mediterranean ' regions of the world, and may be compared, in

particular, with the Cape of Good Hope district in South Africa. We shall find later (p. 373) that in the principal wheat-growing districts of Australia the periods of the year at which rain falls is of very great importance to the crop.

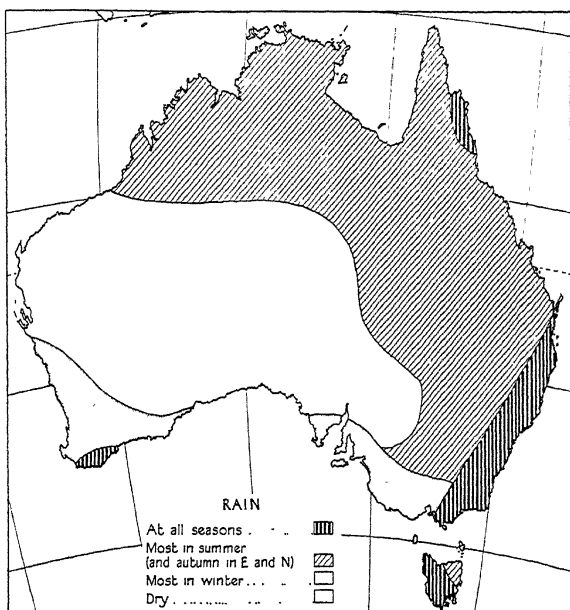


FIG. 120. SEASONAL RAINFALL IN AUSTRALIA. (The 'dry' region has a rainfall mainly under 10 inches in mean annual amount, and uncertain.)

*Vegetation.*—When we look at the map showing vegetation (fig. 121) it is seen that there is a close connexion between this and the climate, especially the rainfall (fig. 119). There is a broken ring of forest around the east and north, and in the south-west, exactly as there is a broken ring of country receiving heavy, or fairly heavy, rainfall. The forests depend for their existence on the rainfall, and for their character on the temperature. The trees are not the same all over Australia. In the north and north-east there is much tropical jungle, with palms and various trees common in the Malay region,

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and a very thick undergrowth. This thick forest only occurs where the rainfall is heaviest. Going inland from the north and north-east coastlands as the rainfall becomes lighter, we find less thick woods, and country of the type called savanna—plenty of trees still, but also much open grass-land and no heavy undergrowth. There are eucalypts or gum trees in these woods and forests, but farther south

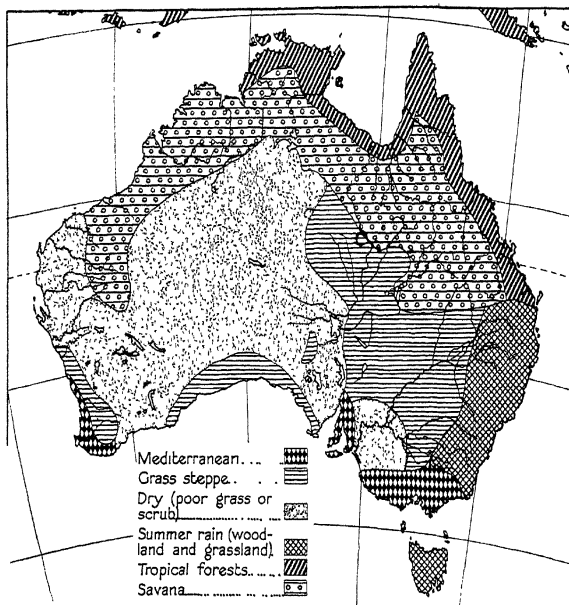


FIG. 121. NATURAL VEGETATION OF AUSTRALIA.

the eucalypts become by far the most numerous trees in the 'bush'. In some particular districts they grow to an immense size, as in Gippsland (Victoria), and in the south-west of Western Australia where there is an annual rainfall of 30 inches or more, and the great karri and jarrah trees grow. There are many different kinds of eucalypts.

There is much open grass-land among these southern forests, and there is not a very dense undergrowth beneath the trees, except in

moist gullies or where the rainfall is very heavy, as in the west of Tasmania, where we find what may be called temperate jungle. But the graceful tree-ferns and other smaller plants lend charm to the 'bush', and the smooth tall trunks and grey-green leaves of the eucalypts, though strange to those who know only the brighter greens of western temperate woodlands or the dark conifers, have their own beauty. Inland, as the climate becomes drier, the trees become fewer, and we pass from woodlands to open prairies, where the trees grow only in clumps or along watercourses. The prairie and more open savanna lands include great tracts of splendid pasture. Farther inland still the grass becomes thinner, and there are only small trees, saltbush, and drier shrubs. This region coincides with the arid region of our climatic division, and in the driest parts of it there are sandy or stony desert tracts with spiny grasses only, or even without vegetation. The dry soils on the inland margin of the prairies and elsewhere in the arid region sometimes, however, become covered with vegetation when there is more rain than usual. As the interior of Australia has become better known, and as, especially in the south-east, irrigation has been extended, large tracts which used to be called 'desert' are found not to deserve that name.

The highlands of Australia are not generally high enough to cause great differences between the vegetation at the bottom and at the top. But in the highest part of the eastern highlands and in the most elevated parts of Tasmania there are no forests; such trees as there are grow small, and the vegetation is of the type called Alpine.

*Animals.*—Even more strange than the plant life, as compared with that of other parts of the world, is the native animal life of Australia. This continent is separated from other lands by great oceans on all sides but one—the north, where it is nearly connected with Asia, through New Guinea and the Malay Archipelago, by a chain of islands. We have before considered (p. 203) the line of division called Wallace's line, between the islands of Bali and Lombok, Borneo and Celebes, and south of the Philippine Islands. In Australia there are the strange marsupials—the kangaroos and wallabies, opossums, native bears, wombats, and others. It is proved from fossils that the marsupials are of very ancient origin, and were once numerous in other parts of the world, though now there are only a few in America. Then there are two mammals which lay



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eggs, the platypus, remarkable also for its curious bill like that of a duck, and the native porcupine ; and there are no such animals as these anywhere else in the world. Many of the birds, also, are either found in the Australian region only, or are most numerous there. Such are birds of paradise, honeysuckers, lyre-birds, cockatoos and paraquets, emus and cassowaries, various pigeons, and kingfishers, including the laughing jackass, which is named from its call, just like a man's hearty laughter. It appears, then, that Australia has been cut off from connexion with other large land areas for a great length of geological time, and that various ancient forms of life have survived here while they have died out in other lands. Men have introduced sheep and cattle, which, we shall find, provide a great part of the wealth of Australia. They have also introduced other animals : rabbits, for instance, have run wild, and in some parts became a serious nuisance to agriculture.

*Population.*—The British Empire possesses in Australia one of its biggest fields for settlement by immigration, and for the development of agriculture and pastoral work, industry, and mining. The aboriginal native inhabitants were few when the continent was discovered by white men : they are fewer now—there are probably about 63,000 altogether. Nothing is known of their origin. They are believed to be descended from people who were driven from India, very long ago, by way of the Malay Islands to Australia. In their natural state they are very low in the scale of civilization, but to some extent they have become absorbed in the white population. They are of little importance in Australian geography, except that many place-names, sometimes strange to our hearing, are taken from their language.

The white population are immigrants or the descendants of immigrants. Men who explored the islands of the Malay Archipelago first saw the west of Australia ; but it looked to them a poor country. In the same way, after a settlement was first made, at the end of the eighteenth century, at Port Jackson (Sydney) on the east coast, it was a long time before men began to spread far over the country and to understand how valuable it might be made. The rugged eastern highlands long prevented settlers from finding their way inland to the rich plains. But when they had done this, the pastoralists with their flocks and herds wandered far over the grass-lands of the

interior, and after them came the cultivators to prove how easily wheat and other crops could be grown as far inland as sufficient rainfall was found. We should expect to find the white population settled mostly where the climate is most like that of the homes from which they or their forefathers have come, and where it, and the physical features of the land, allow them to build up great industries. And so it has happened. The south-east has the largest area of close population, and it is closest at certain points on the coast. This is

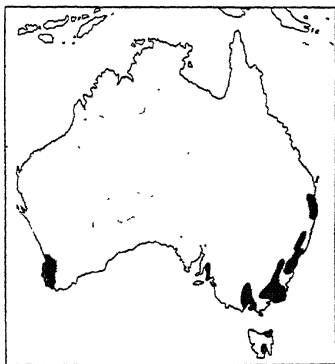


FIG. 122. The parts of Australia where the population is densest (shown in black) and scantiest (in white).

a land with a temperate climate and good rainfall. It has good harbours and sites for large towns, such as Melbourne and Sydney (p. 376), where manufactures may develop. There is plenty of land suitable for various kinds of agriculture; there are timber and minerals, including coal. Again in the south-west, with similar conditions, there is a numerous white population. In both regions men have pushed inland from the coasts to cultivate the prairie lands so far as the rainfall or irrigation (p. 374) allows or to pasture sheep and cattle. The same thing has happened farther north, in Queensland. But in a great part of northern Australia the hotter climate is not that to which white men are so well accustomed. Therefore in the northern territory and in north-eastern Queensland there are several thousands of Chinese and others who are used to a hotter

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climate. These, however, cannot enter in unlimited numbers, because the white inhabitants of Australia wish to keep Australia 'white', and not to let coloured immigrants and their descendants become very numerous—more so, it might be, than themselves. This has made slow the development of tropical Australia. The dry central region of Australia, again, is in great part uninhabited, and must be so. But even here, at two points in particular (p. 374), great mineral wealth has led men to overcome the difficulties of living in these arid lands. The total population of the continent is about 6,000,000.

*Political Division.*—The Commonwealth of Australia is divided into states and territories. The states are New South Wales in the east, Queensland in the north-east, Victoria in the south-east, Western Australia in the west, South Australia in the south, with the island state of Tasmania off the south-east coast. In the north is Northern Australia, till lately administered by the Commonwealth Government, whereas the states, although belonging to the Commonwealth, have also their own parliaments. It was decided in 1926, however, that Northern Australia should be divided into two states, North and Central Australia. Enclosed within the south-eastern part of New South Wales is a small territory called the Federal Territory, which is Commonwealth land and contains the federal capital Canberra, a new city created in order to be the capital, and not, like other great cities of Australia, one which has grown up as a seaport or the centre of industry or trade. Its position is rather one chosen for accessibility from other great centres, and for beauty of scene and attraction of climate, since the site is high enough to be not too hot in summer, yet not so high as to be too cold in winter. The Commonwealth Government also administers the eastern part of the island of New Guinea, to the north of Australia, and other islands in the Pacific Ocean.

*Products.*—The principal exports of Australia are wool, wheat, flour, hides, butter, and fruits, in addition to minerals; which indicate the chief occupations to be the pasturing of sheep and cattle, the cultivation of wheat, and mining. Sheep are pastured principally in the south-east and to a smaller extent in the west, cattle also in the east and in the west, especially the north-west. There are fewer sheep than cattle north of the tropic; cattle can bear greater

heat than sheep. The breed of sheep which has proved the most valuable for wool is the merino. It succeeds better in the drier inland parts than in the wetter coast-lands, and it came originally from Spain, a country where the climate is not unlike that of the parts of Australia where it now flourishes. Other breeds of sheep are better suited to the cooler and wetter climate of the coast-lands. These as a rule yield wool less good, but better mutton. The finest cattle for beef are raised in the hotter regions such as northern Queensland, but cattle-rearing for the dairying industry is more successful in the temperate climate of the south-east.

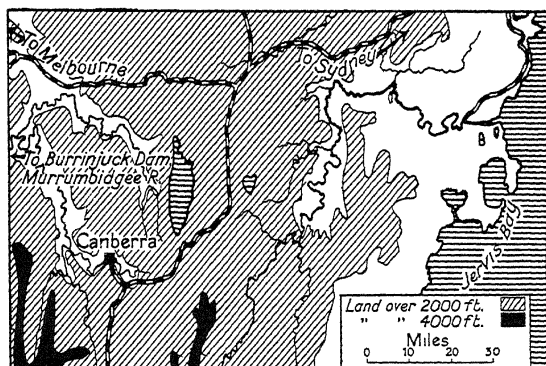


FIG. 123. THE POSITION OF CANBERRA.

The districts most important for the wheat-growing are the lands of the south-east and the south-west where the rainfall is moderate but sufficient at the growing season, April to October. A fall of at least 10 in. during the growing period is necessary, and this point is of special importance because, especially in Western Australia, wheat can be grown with a very low total rainfall for the year, 15 in. or less, because the greater part falls during the growing season. A large cultivation would not be profitable in northern Australia because although there may be as much rain, or more, during the year, it falls mostly in the summer. Moreover, there is greater heat and more evaporation than in the south. The coast-lands are not as a rule suitable for extensive wheat-growing, being rugged and steeply sloping and thickly forested, so that here the farming is

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mainly mixed and farms are small ; but on the open uplands behind the coastal districts there is plenty of room for crops, and much wheat is grown now on land which was formerly used for pasture only.

The fruit production of Australia ranges from the famous apples of Tasmania to the vine and soft fruits of the region in Victoria and South Australia where the climate is of mediterranean character, to the oranges of northern New South Wales and Queensland and the bananas and other tropical fruits of the north. Sugar is another important tropical cultivation, and cotton may become so.

*Irrigation.*—In the drier parts of Australia some important irrigation works have been carried out, particularly in the Murray basin. On the lower middle course of the river Murray, where the annual rainfall is little over 10 in., important agricultural industries have been made possible by using the river water for irrigation. In other parts where there is little or no water on the surface water can be got by drilling deep artesian wells.<sup>1</sup> The most extensive artesian basin covers a great part of the central lowlands southward from the Gulf of Carpentaria and principally in western Queensland. It is generally believed that the subterranean water in this basin comes from the eastern highlands where the rainfall is heavy. The water, falling as rain on the upturned edge of the rocks of the central lowlands which rest against those of the eastern highlands, soaks down through them, according to this explanation, toward the centre of the basin ; and when the upper layers in this basin are bored through, the water is raised by subterranean pressure and sometimes spouts up like a fountain at the surface. The water of artesian wells is commonly warm, and often too salt to be used for irrigating crops, but even then it can be drunk by live stock, and this makes it possible to keep stock in drier country than it would be otherwise.

*Mining.*—The principal minerals worked in Australia are coal, silver, lead, gold, copper, tin, and zinc. It was the discovery of rich goldfields in several parts of the continent which in the early years led to a great inrush of immigrants. In Western Australia one of the principal fields is the East Coolgardie, including Kalgoorlie and other mining towns near which are some of the richest mines in the world. These have been worth developing in spite of the dryness

<sup>1</sup> Part II, p. 455, and fig. 162.

of the country and the distance of 400 miles from the sea. Water is supplied by a line of pipes over 300 miles long from a reservoir on one of the rivers in the west coastal region. Many other gold-fields have been famous in the past, but mining generally, and gold-mining especially, is less important than it used to be. The coal-fields, however, are valuable. Coal is mined principally in New South Wales to the north and south of the city of Sydney, these coal-fields being the richest in the southern hemisphere. In Queensland there is an important field at Ipswich not far from Brisbane, the capital. Silver, lead, and zinc come from the great mining centre of Broken Hill in western New South Wales, another instance of a mining-field being opened up in the dry region of the interior. Iron also is largely worked in New South Wales, and ironfields should increase in importance with the growth of manufacturing industries in Australia. In Tasmania there is a valuable silver and lead field in Mount Zeehan. Copper is worked in South Australia, Tasmania, New South Wales, and Queensland at various points, and tin at Mount Bischoff in Tasmania, in the north-east of New South Wales, and elsewhere.

*Timber.*—Some of the timbers of the Australian forests are valuable, such as the hard Karri and Jarrah woods of the south-western forests. Some of the wattles, common trees in Australia, whose yellow clustered flowers are almost an emblem of the country, supply tannin for the leather obtained from the cattle. Soft woods have to be largely imported ; they are not common in the Australian forests. Much timber has been wasted in Australia as it has been necessary to kill trees and clear them from the land before it could be used for pasture and agriculture in districts where there is no means of transporting it.

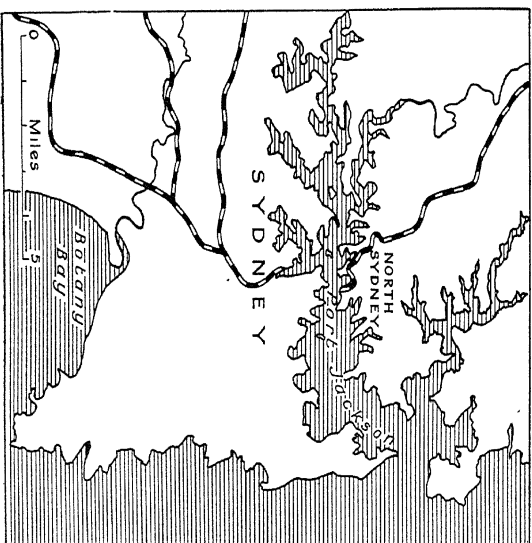
*Trade and Communications.*—Australian commerce consists, broadly speaking, of the export of the raw materials which have been mentioned and the import of manufactured goods from Great Britain, North America, and other manufacturing countries ; but manufacturing industries are developing in Australia itself. The railway communications of Australia consist of a system in Western Australia, South Australia, Victoria, New South Wales, and southern Queensland, which, though connected, is not of the same gauge throughout. In the north there are a number of lines running from

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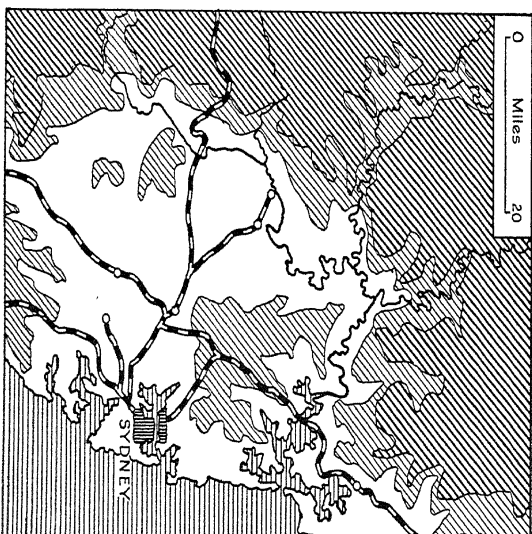
seaports to the interior behind them. A transcontinental line runs from Perth, the capital of Western Australia, and Fremantle its port, to Adelaide, capital of South Australia, Melbourne, capital of Victoria, Sydney, capital of New South Wales, and Brisbane, capital of Queensland. From Perth it runs eastward to the mining city of Kalgoorlie and thence through dry country, where deep wells were sunk, reservoirs made, and pipe-lines laid to supply water. The change of gauge between the various states means that on the transcontinental journey trains have to be changed five times. Apart from the mining centres already mentioned the chief towns are seaports, with the exception of Perth in Western Australia, which is a few miles inland. The railway system of Victoria converges mainly upon the port of Melbourne and that of New South Wales upon the port of Sydney. Both these great seaport cities have been built upon fine natural harbours, Melbourne upon Port Phillip and Sydney upon Port Jackson, one of the most beautiful natural harbours in the world. In South Australia Adelaide, a short distance from the sea, with Port Adelaide as its seaport, carries the principal trade of the State, though Port Pirie serves as an outlet for the Broken Hill mining region. The case of Queensland is rather different. The capital, Brisbane, is the chief port, but the railway system does not centre upon it in the same way as upon the other capitals. The Queensland coast is in great part protected by the Great Barrier Reef, a coral reef extending for many miles parallel with the coast and leaving a quiet channel between it and the coast, protected from the full force of the Pacific Ocean, for communication along the coast-lands. It is partly for that reason and partly because there are more small natural harbours at the mouths of rivers than farther south that a number of important ports have grown up along the coast of Queensland with railways to the interior behind each one; but there is now also a railway northward from Brisbane along the coast. The chief port of Tasmania is Hobart.

Air-routes are useful to connect centres of population far apart in districts otherwise little inhabited. Thus routes have been found serviceable along the west coast of Australia northward from Perth, and between stations in the interior of Queensland and the south-east.

*New Guinea.*—The great island of New Guinea is separated from



(a)



(b)

FIG. 124. THE POSITION OF SYDNEY (a) on its splendid natural harbour; (b) in relation to neighbouring high land (shaded over 500 and over 1,000 ft.).



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the north of Australia by the shallow Torres Strait which is scarcely 100 miles wide at its narrowest part. The western half of the island belongs to Holland and is included with the Dutch colony of Netherlands India. The eastern half is British territory under Australian administration. High mountains run along the length of the island, reaching over 15,000 ft. in the centre of Dutch New Guinea. Great rivers flow north and south from these, and in British territory the Fly river, with many large tributaries, drains a huge expanse of very low, wet land. The coasts are much broken by many gulfs and smaller inlets and many islands lie off them. Much of the interior is unexplored or little known by white men. The climate is hot and trying to Europeans in the lowlands. Mangrove swamps are found along the shores, but in some parts of the coastal lowlands there are grass-lands, with eucalyptus trees ; inland there are dense forests. The natives are not numerous considering the size of the island ; they are divided into many small tribes, often at war with each other, and some are still cannibals. Some of those on the coast are skilful sailors and carry on a good deal of trade. In the British territory they have for the most part taken kindly to British rule and some of them make good workers under the direction of white men. The white settlers number not many hundreds ; but under them a good deal of land has been cultivated, and coco-nuts for copra, rubber, hemp, and other tropical crops are grown. Some gold is worked and oil has been discovered, and there are pearl fisheries in the waters of the Torres Strait both on the New Guinea and on the Australian shores.

### NEW ZEALAND

*Surface Features.*—New Zealand is a dominion of the British Empire which consists principally of two islands, the North Island and the South Island. Both islands are mostly mountainous, and the mountains form backbones running along their length and throwing off long spurs, so that there is not much room for extensive plains. North Island, however, throws out a long, narrow peninsula which is comparatively low ; its coasts are broken by many inlets. All the coasts have plenty of bays sheltered from the open Pacific Ocean ; and in the south-west of South Island, where the highest mountains, the Southern Alps, fall directly to the sea, there are

beautiful fiords like those of Norway but without the fringe of numerous islands. In both islands there are many rivers traversing beautiful well-watered valleys, and in both there are many lovely

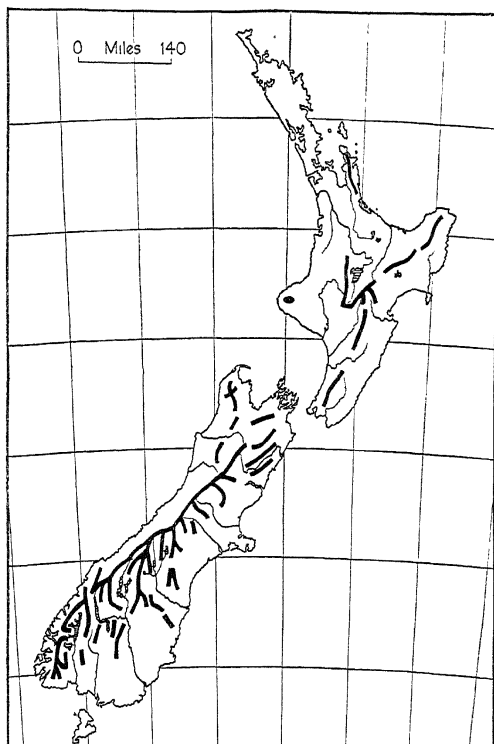


FIG. 125. GUIDE TO THE RELIEF OF NEW ZEALAND.

lakes among the mountains. In North Island a great extinct volcano, Mt. Egmont, forms the south-western point of the island, and in the centre of the island there is a wonderful region where there are hot lakes, hot springs, geysers, and other features of volcanic activity.<sup>1</sup> Very different are the lakes among the Southern Alps ; long, narrow,

<sup>1</sup> Part II, p. 438.

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and winding like the lakes of other mountainous regions such as British Columbia, and not like the crater lakes of North Island and elsewhere. In North Island there is plain country along the narrow

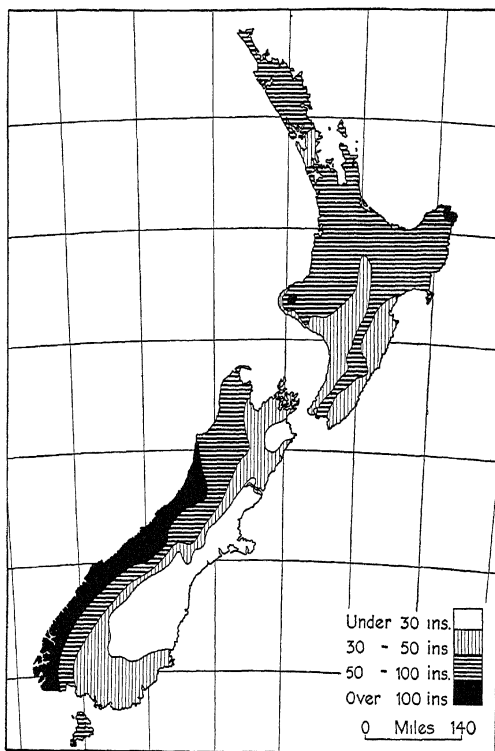


FIG. 126. MEAN ANNUAL RAINFALL OF NEW ZEALAND. The comparison with Fig. 125 is suggestive: especially that between the position of the main chain of mountains and the wetter and drier parts of South Island. In this connexion prevalent winds must be considered (cf. Part II, Figs. 174, 175).

east coastal lowland and at the base of the peninsula. In South Island the principal lowland is in the east midland and is known as the Canterbury Plains.

*Climate.*—The climate is of oceanic type. The islands extend

through thirteen degrees of latitude: the latitude of the north of North Island is the same in the southern hemisphere as the Strait of Gibraltar in the northern hemisphere; and the south of South Island lies in a latitude corresponding very nearly to that of Brittany in the northern hemisphere. Therefore from the south to the north of New Zealand there is a change from cool temperate to warm temperate conditions.

The winds chiefly affecting New Zealand are the westerlies, especially in winter when the belt of westerly winds is in its most northerly position. These winds bring plenty of rain, especially to the western slopes of the South Island. Farther east in the lee of the mountains there is a decrease in the average rainfall except where there is high ground close to the coast. In the interior some parts occasionally receive less than enough rain for agriculture; but no part suffers from severe drought such as may occur in Australia, since the islands of New Zealand are not of sufficient extent for any part of them to lose the influence

of the sea upon the climate. In North Island, where the mountains are not so high as the Southern Alps in the South Island, there is no region of such heavy rainfall, but easterly winds sometimes bring heavy rain to the east coast, and as a whole the rainfall is more equally distributed over the land than in South Island. Summer, however, is relatively dry and warm, and, in the north especially, the climate is not unlike that of Mediterranean type.

*Vegetation.*—Much of New Zealand, with its temperate climate and plentiful rainfall, is covered with evergreen forest. Many trees yield valuable timber, and soft woods are sent to Australia where the forests yield only hard woods. The undergrowth is thick and ferns are characteristic, and the natives used to eat their roots. On the

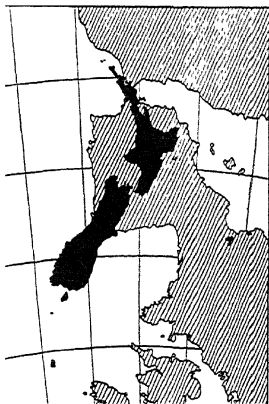


FIG. 127. New Zealand is shown in black. The shading shows the parts of Europe (and a scrap of north Africa) which are the antipodes of New Zealand: they are necessarily reversed from the ordinary map of Europe.

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upper slopes of the mountains and in the drier lowlands of the South Island the forests give place to grass-lands. Some of the native grasses are good for pasture, but in settled parts the land has been sown with imported seeds producing better pasture. An important native plant is the New Zealand flax, and another vegetable product is the gum from the Kauri tree, which is dug out of the ground (in the North Island) where there used to be Kauri forests, and is used for making varnishes.

*Population.*—New Zealand contains about a million and a half immigrants or descendants of immigrants, largely British. The native inhabitants are Maoris, who rank high among coloured peoples in respect of civilization. Many are well educated and good cultivators, and take part in the government of the country. New Zealand in this respect offers a contrast with the other great dominions of the Empire in the southern hemisphere—Australia, where the native population is very small and of little importance; and Africa where, though large, it is less highly civilized than in New Zealand and its relations with the white population are usually those between employee and master. The white population of New Zealand is settled in by far the greatest proportion on the lowlands, and nearly all the chief towns are on the coasts.

*Products, Trade, and Communications.*—The principal products of New Zealand for export are wool, frozen meat, dairy produce, skins, gold, Kauri gum, flax, and timber. From this it appears that the pastoral industries are of chief importance; and it is said that the most important event in the history of New Zealand's trade was the introduction of methods of freezing mutton for export, so that the meat as well as the wool of sheep could be exported, as also the products of the dairy. The principal pastoral and agricultural lands are naturally found in the lowlands and less mountainous parts. The Canterbury Plains form a great agricultural and pastoral district, and the name of Canterbury lamb, which is familiar in Britain, is given properly to lamb imported from this part of New Zealand. Oats and wheat are the most extensively grown crops, but in the north of North Island, where the climate is somewhat of mediterranean type, such crops as maize, and the cultivation of the vine and many other fruits, are found. Gold and coal are mined in both islands. The industries are principally those connected with

the freezing of meat, butter- and cheese-making, saw-milling, tanning, and wool-scouring. A good geographical reason why manufacturing industries should be developed in New Zealand is that many of the rivers, rapidly flowing and never running dry, might be used to supply electrical power, as some of them are already used. The principal ports are Auckland in the north and Wellington in the south of North Island, Lyttelton, The Bluff, and Dunedin (Otago) in South Island. Lyttelton is the port for the city of Christchurch and The Bluff for that of Invercargill. Railways have been built through the most populous districts in both islands, and open up the more important agricultural and mineral districts.

#### THE PACIFIC

The Pacific Ocean east of Australia, New Guinea and the Philippine Islands as far as 130° W. long., and between the tropics, contains an immense number of small islands. The whole of them is sometimes spoken of as Oceania. Within this huge area of ocean it happens occasionally to this day that islands are reported by sailors which have never been seen before so far as is known. Sometimes when reported they cannot again be found; but by degrees the great majority, and especially those which lie in the tracks of shipping regularly crossing the ocean, have become well known, although many have two or more different names because different explorers sometimes found the same island and gave it different names, or used the native name, when they did not know the island had been found and named before. For the most part the islands are either volcanic (though generally the volcanoes are extinct), or are made of coral built up by the coral organisms living in the sea. Volcanic islands are generally high and have rich vegetation. The coral islands are very low and ring-shaped with a lagoon, or sheet of calm water, in the middle. Coral islands of this form are called atolls, a name originally taken from the Maldivé Islands in the Indian Ocean. The ring may occasionally be unbroken; more often it consists of a number of separate islands with narrow passages between them leading into the lagoon. Both atolls and volcanic islands are in their different ways extremely beautiful. Any one who would read descriptions of them may find them in the works of Robert Louis Stevenson. For example, there is in *The Ebb Tide* a wonderful

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description of a coral atoll. The volcanic islands with their high peaked summits and their steep craters, sometimes partly broken down and entered by the sea, are generally richly covered with vegetation. The vegetation of atolls is not rich in numbers of plants but they usually bear the coco-nut palm, which as we know is valuable for many products and especially in commerce for copra, the dried kernel of the nut, from which oil is pressed. From some of the islands phosphates and guano are obtained. On the volcanic islands ferns and many other beautiful plants flourish ; in some the natives are very fond of flowers and wear wreaths of them. Many tropical fruits such as bananas, oranges, and pine-apples flourish but have mostly been introduced by man into the islands. The coco-nut, yam, and bread fruit are important for food.

The islands are divided into three great divisions : Melanesia in the west, Micronesia the north and central division, and Polynesia in the east. The Melanesian natives are blacks, and Melanesia means ' the islands inhabited by blacks '. The Polynesians and Micronesians are brown-skinned people of a higher type, and in these cases the names of the group do not refer to the natives but mean merely ' many islands ' and ' small islands '. In earlier days, and even now to some extent, it has been found difficult to bring law and order into these islands, and white men who have visited them or settled in them have not always been of the best kind. They have introduced vices among the natives. Moreover, natives have sometimes suffered worse than white men do from diseases which they have caught from them. Therefore in many islands the natives have unhappily decreased in number and become less strong and healthy in type. In Melanesia, off the eastern part of New Guinea, there are several groups of large islands in which the natives are very treacherous and some are cannibals. New Caledonia, the nearest of the large oceanic islands to Australia, is best known as the place to which French convicts used to be sent ; and many remained there. The French, who possess the island, call the natives Kanakas, a native word meaning ' man ', which is also commonly used by Europeans of the native peoples elsewhere in the Pacific. The New Hebrides are mainly volcanic and have some mineral wealth. Both British and French traders are established here, and Britain and France control the islands jointly. Fiji, to the east of the New Hebrides, belongs to

the British Empire, and here the natives, though formerly cannibals, are fine people of good type. Sugar is grown and exported, together with copra and bananas. A number of Indians have been brought here as labourers and have settled as traders. All these islands are in the division of Melanesia. The small islands of Micronesia produce little else than copra. Some of them are famous as containing remains of great stone buildings which must have been set up by an ancient race now vanished, for none of the native peoples nowadays knows how to build in such a way or to transport the heavy stone. Among the Polynesian Islands is Hawaii, a group belonging to the United States of America. One of the Hawaiian islands contains the volcano of Kilauea, the crater of which is the largest in the world. Samoa is a beautiful group administered by New Zealand and producing copra and cocoa. The Society Islands in the eastern part of Polynesia belong, with others in this region, to France. They are generally volcanic and high, and travellers say that they are the loveliest in the whole ocean. The principal of them is Tahiti.



## EXERCISES

1. Australia includes regions which have (a) rain at all seasons ; (b) rain mainly in summer ; (c) rain mainly in winter ; (d) rain at no season. Give one district belonging to each group, and account for the distribution in each case.

2. Divide Australia into natural regions according to the structure, and point out the characteristics of each.

3. Why did the south-eastern portion of Australia progress more rapidly than the rest of the continent ?

4. By what means are some of the drier parts of the continent being developed ?

5. Compare New Zealand as regards latitude, extent, and climate with the British Isles, and give a brief account of the development of New Zealand industries.

6. Give the distribution of forests and grass-lands in Australia. Name any trees or plants which are peculiarly characteristic of the continent. What use is made of the grass-lands ?

7. Describe the great inland-drainage area of Australia, and compare it with similar areas elsewhere.

8. Describe the Southern Alps of New Zealand, and compare them with the Alps of Europe. How do the Southern Alps influence the climate of New Zealand ?

9. Compare and contrast (a) the plains of Australia with the plains of New Zealand ; (b) the natives of Australia with the Maoris.

10. What standard times are used in Australia and New Zealand ? How are these fixed ? (Cf. Part II, p. 399.)

11. Give an account of the means of communication in Australia (a map should be drawn).

12. Describe the basin of the Murray-Darling, and give an account of the agricultural industry there.

13. What is meant by an artesian basin ? Show these basins on a map of Australia. What is an artesian well ? Explain, by aid of diagrams.

14. In what parts of Australia are cattle and sheep reared ? The products of these two industries supply exports to the value of more than half the total. How do you account for this ? Name the products of these industries.

15. What geographical factors have led to the growth and importance of Sydney, Melbourne, Adelaide, Brisbane, Perth ?

16. What parts of Australia produce the following : sugar, cotton, maize, and wheat ?

17. What do you understand by the policy of ' white Australia ' ? How does this affect the development of tropical parts of the continent ?

18. What parts of Australia are devoted to mining ? Do you notice anything peculiar in the distribution of mineral deposits ? What are the special difficulties of the mining industry ?

19. What parts of Australia have a mediterranean type of climate ? Name the products and towns of any one of these divisions.

20. Give an account of the trade between Great Britain and Australia. What routes are followed by shipping engaged in this trade ?



PART II

THE EARTH, AND ITS SURFACE :  
THE WORLD AND ITS REGIONS



## XI. THE EARTH'S SHAPE AND MOVEMENTS AND SOME OF THEIR CONSEQUENCES

*The Earth's Shape.*—The earth is a ball ; almost a sphere, though not exactly. This is known from a number of simple observations. Thus, if we can see the horizon all around us—at sea, for example—it is always a circle, from whatever height above the earth's surface we see it. The horizon is the line at which earth and sky seem to meet, and the fact that, if the air be clear, it is seen as a distinct line suggests that we are not looking out over a dead level, but over a surface which is curved, downward from us, so that we cannot see it beyond a certain distance. Again, if in clear weather and a calm sea, a ship is watched sailing away, its hull is lost to sight first, its masts last ; and people on the ship lose sight of the beach before the higher ground of the land they are leaving. These illustrations from the sea remind us that a ship can sail round the world ; though this alone does not prove the figure of the earth to be a sphere. But another simple fact, which is proof, is that when the sun throws the shadow of the earth upon the moon, causing an eclipse of the moon, which we can see, the edge of the shadow is always an arc of a circle ; but if the earth were not a sphere (nearly), the outline of its shadow would differ according to its position relatively to the moon when the eclipse occurred.

In passing, it may be remarked that the distance of the horizon in miles equals the square root of the figure for the height of the observer in feet above the ground (or sea), multiplied by 1·22. Thus, to obtain roughly the distance of the horizon at sea, take the square root of the height of your eyes, in feet above the sea, add a fifth, call the result miles, and you have it. The curve of the earth's circumference equals a slope of 8 inches in a mile.

*The Cardinal Points.*—A model of the earth is called a globe ; from this, the earth itself is sometimes called ' the globe '. Before starting upon any description of its surface, we need to be able to define the direction and position of any point or part of it. This obviously cannot be done as one might define the position, say, of a dot on a sheet of paper, by relation to the top, bottom, and sides

no top or bottom, nor, clearly, has a globe any edges. But the fact that the earth does move in a certain way gives us a means of expressing direction. The earth has two principal movements ; one is that it spins or rotates. The ends of the axis around which it rotates are called the poles ; one, the north pole ; the other, the south pole. If we face the north, with backs to the south, the direction midway between these two, to our right, is east, and that midway to our left, west. We have now four cardinal or chief

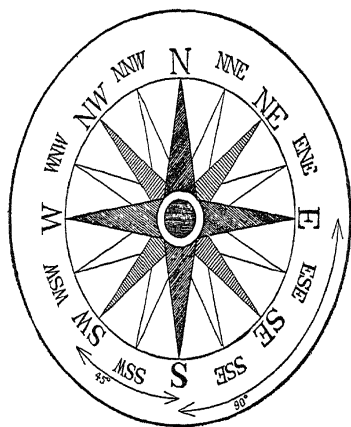


FIG. 128. THE POINTS OF THE COMPASS.

points of direction, and we can express clear directions by their means ; thus, a direction midway between north and east is north-east ; between north and north-east, north-north-east ; between north-east and east, east-north-east ; between north and north-north-east, north by east, and so on.

*The Compass.*—There are various ways, more or less easy and more or less accurate, of finding the north and south directions. Any one who has, or has seen, a compass, knows that it consists of a needle of magnetized steel balanced on a pin. The earth is a magnet of sufficient power to cause the needle always to come to rest pointing north and south, provided that the compass stands or is held steady, and is not influenced by some magnetic substance near at hand. But the needle points to the magnetic poles, which

are not in the same positions as the poles of the earth's axis, though not far from them relatively to the size of the earth. It follows that the compass does not usually point exactly to the north and south ends of the earth's axis, or (as they are called) the geographical poles ; in other words there is a difference between ' magnetic ' and ' true ' north (or south), the word ' true ' being applied to the direction of the geographical poles. This difference is called the magnetic declination or variation.

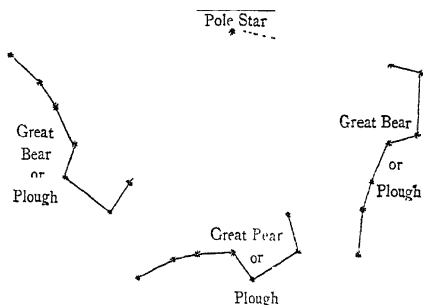


FIG. 129. THE POLE STAR (at the top), and the position of the ' Great Bear ' or ' Plough ' star-group in relation to it, at intervals of four hours.

A stick set upright in the ground throws a shadow north and south (true) when the sun shines upon it at midday, at the moment when the shadow is shortest. The end of the shadow away from the stick points north in the northern hemisphere ;<sup>1</sup> south in the southern. Another rough method of finding direction, in the northern hemisphere, is to hold a watch, keeping good time of course, face upward with the small hand pointing in the direction of the sun : a line half-way between the small hand and a line from the centre of the watch-face to the figure XII on the dial points to the south. On a clear night in the northern hemisphere the north can be found roughly from the direction of the Pole Star, and that star can be found by projecting an imaginary line through the two stars of the Great Bear or Plough group, which are called the Pointers. In the

<sup>1</sup> Hemisphere : a half of the ' sphere ' or Earth.



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southern hemisphere there is a group of stars called the Southern Cross which gives a line upon the south pole.

*Position on the Globe.*—Next, as to position : here the model globe is helpful ; so is an Association football, or an orange with a knitting-needle through it to represent the north-and-south axis.

*The Equator.*—The globe will have a line around its middle—or one can be drawn on the football or cut on the orange—half-way between the north and south poles, making a division into equal parts, north and south halves or hemispheres, and for that reason known as the Equator.

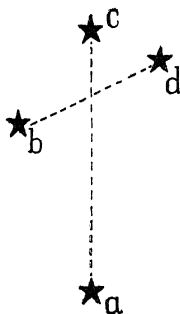


FIG. 130. THE SOUTHERN CROSS.

*Great Circles.*—The Equator is called a great circle, because it is one of the circles which can be drawn around the full circumference of the globe. Obviously no other great circle can be drawn parallel to it ; on the other hand, a large number of great circles can be drawn, each passing through both poles, and cutting the plane of the Equator at right angles. The model globe has some of these circles drawn upon it ; the seams of the football, or the divisions of the orange under the peel, illustrate great circles.

*Longitude and Latitude.*—These great circles, which pass through the poles, provide us with meridians of longitude ; usually one-half of each of them, from pole to pole, is called a meridian. An explanation of this term will come later. Again, on the globe, small circles are drawn parallel to the Equator ; they are ' small ' circles because they are necessarily smaller than the great circle of the Equator, and they are called parallels of latitude. Now we can define the position of any point on the earth's surface, by saying that it is situated where a particular parallel, or the Equator, cuts a particular meridian ; but to do this we need some system of distinguishing each meridian and parallel.

For this purpose the Equator is divided into 360 degrees, usually written  $360^\circ$ . A right angle is  $90^\circ$ , and we may imagine two diameters of the equator-circle cutting at right angles and thus forming four right-angles,  $90^\circ \times 4 = 360^\circ$ . A meridian is supposed to be

drawn through each of these and numbered from  $0^{\circ}$ . The meridian taken in most countries as  $0^{\circ}$ , or the prime meridian, is that which passes through the famous astronomical observatory at Greenwich, in London. And the rest of the degree-meridians are usually numbered from  $1^{\circ}$  to  $179^{\circ}$  eastward, and from  $1^{\circ}$  to  $179^{\circ}$  westward of the Greenwich meridian, while the line of  $180^{\circ}$  is the other half of the great circle which forms the meridian of  $0^{\circ}$ , on the opposite curve of the globe.

The parallels of latitude are numbered according to the two right angles between the plane of the Equator and the earth's axis north and south of it, the Equator being numbered  $0^{\circ}$ , the two poles  $90^{\circ}$ , and the intervening degree parallels  $1^{\circ}$  to  $89^{\circ}$ . We may sometimes in our description of the world have come across a country, or a particular type of weather or some other phenomenon, described as being or occurring 'in low latitudes' or 'in high latitudes'; this refers to the numbering of the parallels of latitude, those which have the lowest numbers being nearest to the Equator, and those which have the highest being nearest to the poles.

Our definition of the position of any point on the earth's surface, then, is expressed in relation to the Equator and the meridian of Greenwich. Let us say, for example, that a point is where the parallel of latitude  $50^{\circ}$  north of the Equator cuts the meridian of longitude  $20^{\circ}$  east of Greenwich; then it would be defined, briefly, as situated in fifty degrees north, twenty east, and the position written as  $50^{\circ}$  N. lat.,  $20^{\circ}$  E. long.; or, as latitude only can be north or south, and longitude only east or west, these may be left out, and the position given as  $50^{\circ}$  N.,  $20^{\circ}$  E. A position very accurately defined may, of course, have to be given in degrees, minutes, and seconds, written, for instance,  $49^{\circ}59'38''$  N.,  $20^{\circ}1'57''$  E.

The length of a degree of longitude decreases from slightly over 69 statute or land miles<sup>1</sup> at the Equator, to little over a mile<sup>2</sup> at  $89^{\circ}$  N. or S. lat., as the meridians converge at the poles. The length of a degree of latitude, on a perfect sphere, would be the same as that of a degree of longitude on the Equator; in reality this measurement varies slightly as the earth is slightly flattened at the poles, but the extreme of variation is only about 1,200 yds. The mean equatorial diameter of the earth is 7,926 miles; the polar diameter 7,900 miles.

<sup>1</sup> 69.16.

<sup>2</sup> 1.21.

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*Metric Measure of Distance.*—Although we do not generally use the metric system we sometimes come upon lengths or distances reckoned in metres, or in kilometres or other multiples or fractions of the metre. It is therefore worth noting that the metre, the metric unit of length (equal to 39·37 inches in our usual system), is reckoned as one ten-millionth part of the length of one quarter of a meridian great circle ; that is to say, the distance along a meridian from the Equator to a pole of the earth. Metres can be roughly converted to yards by the formula ‘metres  $\div \frac{1}{10}$  = yards’. Thus 300 metres are nearly 330 yards (328·08). The kilometre is a thousand metres, and equals, roughly, five-eighths of a mile.

*Distance and Direction at Sea.*—Another measurement which we may encounter is the nautical mile or sea-mile. There are 60 of these in a degree of latitude at the Equator ; a sea-mile is therefore equal here to a minute of longitude, and to that extent is easier to reckon. One often reads that the speed of a ship is so many knots ; this means so many sea-miles per hour, the knot being a measure of speed (one sea-mile per hour), though it is often used wrongly as a measure of length equal to a sea-mile. And while on the subject of the sea, and before leaving that of great circles, it may be remarked that these can be drawn in any direction round the globe, not necessarily passing through the poles or marking the Equator. Only these last are of use in defining position ; but (if you think of it) an arc of a great circle is the shortest distance between any two points on the surface of a sphere, and ships sailing long voyages across the great oceans often have their courses laid along arcs of great circles, or along chords of such arcs.

*Position-finding.*—A natural question at this point is : how does a sailor or a traveller through unknown country find his own latitude and longitude ? Latitude is found by means of observations with accurate instruments of the angle between the horizon and a star or the sun ; we cannot go into details yet, but Fig. 131 is a picture of a man doing it, with an old-fashioned instrument no longer in use, but clearly illustrating the method. And here is a simple example. Suppose a man at the North Pole : the pole star would be almost exactly at the zenith (which is the name for the point in the sky directly above one's head). If he pointed one arm to the star and one to the horizon, the angle between the two would be 90°—and the

latitude of the pole is  $90^\circ$  N. of the Equator. Suppose he moved  $40^\circ$  southward, and again pointed one arm at the star, holding the other horizontal as before; then the angle formed by his arms would make, not  $90^\circ$ , but  $90^\circ - 40^\circ = 50^\circ$ , and his latitude would be  $50^\circ$  N. Latitude is also to be found by observing the altitude of the sun. From fig. 132 it is seen that when the sun is overhead at the Equator  $E$  the angle  $ECP$ , which is the latitude of the point  $P$ , is

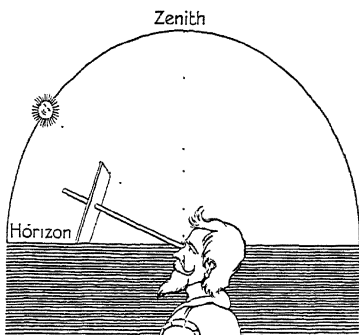


FIG. 131. An old picture showing (in a simple way) how a man sighted the angle between the sun and the horizon. The cross-piece was made to slide on the rod.

equal to the angle which the sun's direction makes with the zenith, at noon. The sun is only overhead at the Equator at noon twice in the year, but latitude can always be worked out from the sun, because it is known how much higher or lower the sun is at any time, than when it is overhead at the Equator. But this will be easier to understand after reading a little further on.

Longitude is usually determined by a comparison of time. This leads on to the subject of time generally, and brings us back to the subject of the earth's rotation.

*Time and the Earth's Rotation.*—We have seen that the earth rotates or spins upon its axis. By careful arrangement of our globe, football, or orange in relation to a lamp, and causing the globe to spin, it is easy to see what happens. Obviously, the half of the globe turned toward the lamp is lit up; the half turned away is in the dark. So with the earth: the half turned toward the sun is lit up and there is daylight; the half turned away is dark, and it is night. The

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earth's rotation is toward the east ; it therefore causes the sun to appear to rise in the east, to climb higher in the sky until midday or noon, then, during afternoon, to sink toward the west, until evening when it sets below the western horizon. The period between one noon and the next is a day of twenty-four hours, and this, therefore, is the apparent length of time which the earth takes to make one rotation. The meridian of any place passes under the sun at midday,

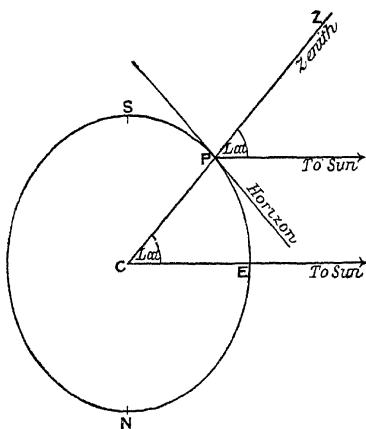


FIG. 132. Diagram illustrating the determination of latitude.

and this is the meaning of the term 'meridian' to which we have referred already. Clearly two meridians cannot pass under the sun at once ; when it is noon at Greenwich, for instance, it is noon at all other places on the meridian of Greenwich, but nowhere, properly speaking, east or west of Greenwich and its meridian. In practice, of course, the whole of a country which is not too wide

in extent uses the same time for convenience ; thus all Britain, and Ireland, use Greenwich time. But actually, the earth, as we saw, appears to rotate once in twenty-four hours, which means that it turns through  $360^\circ$  in that time, or through  $15^\circ$  in an hour, or through  $1^\circ$  in four minutes. At a point  $15^\circ$  E. of Greenwich, time would naturally be an hour ahead of Greenwich time, because, as the rotation of the earth is eastward, the sun is over the meridian of  $15^\circ$  E. an hour before it will be over the meridian  $0^\circ$ . At a point  $15^\circ$  W. of Greenwich, time is an hour behind that of Greenwich.

The following details about time in the principal countries of the world may be useful for reference. They illustrate what is said above about having a common time, for convenience, so far as possible for the whole of a country or state. The meridian

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which passes through the centre of each area is given, and a few of the chief towns are mentioned. It would be very inconvenient if every separate town used its own local time according to its own meridian. To take one of the instances given below—the time at Tokyo in Japan would, according to its meridian, be 9 hours and 19 minutes ahead of Greenwich, but for convenience 9 hours is used for the whole of Japan.

*Countries using Greenwich time* are Great Britain and Ireland (London, Dublin, Belfast), Western European countries including France (Paris), Belgium, Spain (Madrid), Portugal (Lisbon), and Algeria in north Africa.

### *Countries in East Longitudes : Time ahead of Greenwich*

<i>Countries, &amp;c.</i>	<i>Central Meridian, E.</i>	<i>Time ahead of Greenwich.</i>	<i>Chief Towns, Examples.</i>
Central European countries, and Norway and Sweden	15°	1 hour	Berlin, Vienna, Prag, Budapest, Rome, Oslo, Stockholm.
African countries including Tunis, Belgian Congo, Angola, South-west Africa	ditto	ditto	—
Eastern European countries, Egypt, East Africa, British South Africa	30°	2 hours	Moscow, Athens, Cairo, Cape Town.
India and Ceylon,	82°50'	5½ hours	Bombay, Delhi, Colombo.
<i>excepting :—</i>			
Calcutta	90°	6 hours	—
Burma	97°50'	6½ hours	Rangoon.
South-eastern Asia, including Malay States, Straits Settlements, &c.	105°	7 hours	Singapore.
Asia, east coast (China, &c.)	120°	8 hours	Peking, Shanghai, Hong-Kong.
Western Australia	ditto	ditto	Perth.
Japan	135°	9 hours	Tokyo, Yokohama.
South Australia	142°30'	9½ hours	Adelaide.
Eastern Australia (Victoria, New South Wales, Queensland, Tasmania)	150°	10 hours	Melbourne, Sydney, Brisbane.
New Zealand	172°50'	11½ hours	Wellington, Auckland, Christchurch.

From the above table we find the reason why—to take a simple illustration—people in England know the result of a day's play in a cricket match in Australia in the morning of the same day : it is, for instance, six o'clock in the evening at Sydney in eastern Australia when it is eight o'clock in the morning of the same day in England.

*Countries in West Longitudes: Time behind Greenwich*

<i>Countries.</i>	<i>Central Meridian, W.</i>	<i>Time behind Greenwich.</i>	<i>Chief Towns, Examples.</i>
S. America (Brazil, east coast)	45°	3 hours	Rio de Janeiro.
N. America (Atlantic time-zone : Newfoundland, eastern Canada, north-eastern United States)	60°	4 hours	Halifax
S. America (interior of Brazil, Argentina, &c.)	ditto	ditto	Buenos Aires.
N. America (eastern zone : Quebec and Ontario in Canada ; eastern U.S.A.)	75°	5 hours	Montreal, New York.
Central and S. America (Panama to Chile)	ditto	ditto	Valparaiso.
N. America (central zone)	90°	6 hours	Winnipeg, Chicago.
N. America (mountain zone)	105°	7 hours	—
N. America (Pacific zone)	120°	8 hours	Vancouver, San Francisco.

It will be seen from the above table that North America is divided into time-zones of 15° each. At certain stations on the transcontinental railways, near the edges of the zones, time is changed during the train-journey, so that a train west-bound may arrive, say, at 12 noon, stay twenty minutes, and leave at 11.20 a.m. Something of the same sort happens on long sea-voyages, clocks and watches being adjusted every day to the position of the ship. When travelling eastward, toward the sunrise, we see the sun rising, apparently, a little earlier each day than the preceding day ; when westward, a little later. By the time the meridian of 180° is reached, the time gained or lost each day itself amounts to a day. Therefore, on a ship crossing 180° long. eastward, the day following Sunday would also be called Sunday ; but if sailing westward, the day following Sunday would be called Tuesday.

It can now be understood how longitude can be calculated where it is not known, for example on a ship at sea. Chronometers (very accurate clocks) are carried, and from a comparison of the time by one of these set to Greenwich time with an observation of the sun as it crosses the meridian of the ship at noon, the longitude can be calculated. Time-signals given by telegraphy from Greenwich or some other known point may also be useful.

The value of 'summer time', when clocks are put an hour in front of standard time, is to 'save daylight', since it gives an hour longer of daylight in the evenings when it is of use to most people. Some dislike it; a few are believed to think it even sinful, as interfering with natural arrangements. This is a misunderstanding, for standard time itself, as we have seen, is arranged according to convenience, not strictly according to the sun, and we shall find a further illustration of this presently. There are instances in which different places are allowed to choose whether they use summer time or not, as in Canada, where railways work to standard time but some cities use summer time, and this is apt to lead to confusion.

*The Earth's Revolution.*—We have dealt so far with the rotation or spinning of the earth; we now come to its revolution. While it spins, it is also travelling around the sun, as a boat might sail around a ship; this is its revolution around the sun, as distinct from its rotation around its own axis. The revolution takes a year, and determines the length of our year, but not exactly, because the period of revolution is not equal to an exact number of days. Actually the apparent time of revolution is 365 days, 5 hours, 48 minutes, 46 seconds; therefore we reckon 365 to the year usually, but to every fourth year except one, in each century, we add a day, and call the year a leap-year. This extra day makes up for the  $5\frac{3}{4}$  hours (roughly) lost in each ordinary year.

The earth's orbit, as the course of its revolution around the sun is called, is very nearly a circle, and the earth travels on this orbit at an average speed of about 66,000 miles an hour. The orbit is practically in the same plane, and if we imagine this plane to be extended through space, the line where it intersects the dome of stars in the sky can be used to show the apparent position and movement of the sun in relation to the stars. This line is known as the ecliptic, and the groups of stars through which it passes are well



known as the twelve signs of the Zodiac. These 'signs', in one form or another, have been in use from very early times — perhaps for four thousand years or more : the term Zodiac is derived from a Greek word meaning a small animal, and seven out of the twelve signs are now known by animals' names. Two of them have an interest for us which will appear presently.

The earth's axis is not perpendicular to the plane of the ecliptic, but is inclined at  $23\frac{1}{2}$  degrees from the perpendicular position. A model globe is usually set on its stand at this angle, and by moving it in an orbit around a light, and with the help of the figure here (fig. 133) it is most easy to understand the very important results of this inclination of the earth's axis combined with its revolution. These results are as follow.

*The Seasons of the Year.*—The periods of light and darkness during the day are different at different times of the year. We know, of course, that this is so : here is the reason for it. If the earth's axis were perpendicular to the plane of the ecliptic, the equator would always be in that plane, and every part of the earth would have twelve hours' daylight, when turned, by the earth's rotation, toward the sun, and twelve hours' darkness when turned away from it. What actually happens is that on two days only in the year, March 21 and September 23, the plane of the Equator passes through the sun, and all parts of the earth, from the poles to the Equator, have twelve hours' daylight and twelve hours' night. The sun, seen from the Equator, appears in the zenith, or directly overhead at noon. Each of these days and the periods about them is called an equinox or period of equal night (and daytime) ; in the northern hemisphere the March period is distinguished as the spring equinox and the September period as the autumn equinox.

Let us consider a year starting from the northern spring equinox. As the earth moves along its orbit, its north pole is gradually inclining toward the sun, until three months later the sun appears in the zenith on the parallel of  $23\frac{1}{2}^{\circ}$  N. Now, in the northern hemisphere, we have the longest periods of daylight and the shortest of darkness ; 'the longest day and the shortest night,' as we say : it is midsummer, and indeed, within  $23\frac{1}{2}$  degrees of the North Pole there is no 'night'.

*The Tropics and Polar Circles.*—We have here the explanation of two parallels which are always drawn on globes and maps, whatever

others may be drawn. The one is that of  $23\frac{1}{2}^{\circ}$  N., and it is called the Tropic of Cancer—Cancer, or the Crab, because at this season the sun is in the sign of the Zodiac called Cancer; and tropic, a word signifying a turning-place, because from this time onward the sun

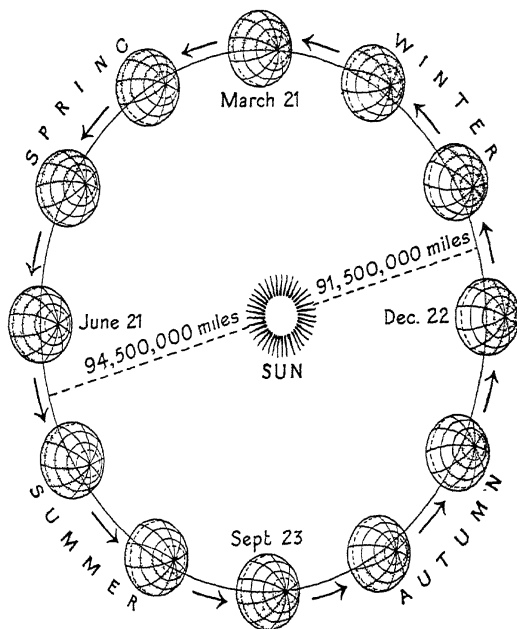


FIG. 133. The pole shown in the little hemispheres is intended for the North Pole. To read the figure as if the South Pole were intended, it would be necessary to transpose the dates of June 21 and December 22, and also those of March 21 and September 23; also the distances from the sun (p. 405) would have to be transposed. The reasons for these changes should be understood from the text.

appears to turn back upon its yearly course. It is never at the zenith farther north than  $23\frac{1}{2}^{\circ}$  N. The other parallel is that of  $66\frac{1}{2}^{\circ}$  N. ( $90^{\circ} - 23\frac{1}{2}^{\circ} = 66\frac{1}{2}^{\circ}$ ), and it is called the Arctic Circle: it encloses the Arctic region, around the North Pole.

Meanwhile, what is happening in the southern hemisphere? It

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is midwinter there ; the sun is at its lowest altitude, and within the Antarctic Circle, the opposite to the Arctic, at  $66\frac{1}{2}^{\circ}$  S., the sun is not seen.

Our year passes on to the September equinox, which is that of autumn in the northern hemisphere, but of spring in the southern ; and three months later again, in December, the sun reaches the zenith at noon over lat.  $23\frac{1}{2}^{\circ}$  S., a line shown on globes and maps as the Tropic of Capricorn, the Goat, from the sign of the Zodiac in which the sun now appears. Now it is midsummer in the southern hemisphere, midwinter in the northern ; within the Antarctic Circle the sun does not set ; within the Arctic circle it does not rise. And so on to the March equinox again, which, being the spring equinox of the northern, is the autumn equinox of the southern hemisphere.

' *Day* ' and ' *Night* ' *Periods*.—A few figures for reference may help to explain all this.

*Periods for which sun is above horizon ( ' day ' ) and below ( ' night ' )*

		<i>Summer months</i>		<i>Winter months</i>	
NORTH POLE		189 days above horizon		176 days below horizon	
<i>North Latitude.</i>	70°	70°	" " "	55°	" " " "
		<i>Midsummer day</i>		<i>Midwinter day</i>	
	60°	18 $\frac{3}{4}$ hours above horizon		5 $\frac{3}{4}$ hours above horizon	
	50°	16 hrs. 18 mins.	" "	8 hours	" "
	40°	14 hrs. 58 mins.	" "	9 hrs. 16 mins.	" "
	20°	13 hrs. 18 mins.	" "	10 hrs. 53 mins.	" "
EQUATOR Practically equal throughout year—12 hrs. 4-5 mins. above horizon.					
		<i>Midwinter day</i>		<i>Midsummer day</i>	
<i>South Latitude.</i>		10 hrs. 53 mins. above horizon		13 hrs. 18 mins. above horizon	
		9 hrs. 16 mins.		14 hrs. 58 mins.	
		8 hrs.		16 hrs. 18 mins.	
	60°	5 $\frac{3}{4}$ hrs.	" "	18 $\frac{3}{4}$ hrs.	" "
		<i>Winter months</i>		<i>Summer months</i>	
	70°	59 days below horizon		65 days above horizon.	
SOUTH POLE		183 " " "		182 " " "	

It follows from the above statements that in summer, even at latitudes much lower than the Arctic and Antarctic circles, there is little or no darkness at night, and that there are long periods of evening twilight and dawn light, after sunset and before sunrise, when the light effects are often wonderfully beautiful. This is in contrast with what happens in low latitudes, where daylight and darkness follow one another almost at once. ' Slowly the sun sank,

and then suddenly darkness rushed down on the land like a tangible thing'—this is a description of nightfall given in one of Sir H. Rider Haggard's books of African adventure, *King Solomon's Mines*.

*The 'Midnight Sun'.*—It will also be gathered that about and within the Arctic and Antarctic circles the sun is seen in summer at midnight, a sight strange to us who do not live within the polar regions, and one which, in the northern hemisphere, draws many travellers to see it; most of us have heard the north of Norway spoken of, for example, as 'the land of the midnight sun'—a name which of course does not properly belong to it alone (see further, p. 406).

*Perihelion and Aphelion.*—It was said above that the earth's orbit is nearly a circle. The earth is in fact about  $91\frac{1}{2}$  millions of miles from the sun in December and about  $94\frac{1}{2}$  millions in June. This has a tendency to make the winter (June) climate of the southern hemisphere rather colder than that of the northern (December), and the southern summer (December) rather warmer than that of the northern (June). The position nearest the sun is called perihelion, and that farthest from the sun aphelion, from Greek words bearing these meanings. The earth moves rather faster in perihelion than in aphelion, and because of this and the inclination of the axis to the plane of the orbit, the day actually, though not in practice, varies slightly in length at different times of the year; moreover, the movement along the orbit (revolution) has the effect that the sun is not brought above any one meridian twice within exactly the period of the earth's rotation but within a period nearly four minutes longer. We need not go further into these questions here, but they are mentioned by way of suggesting, with what was said above about the year and local time, that our whole system of time-measurement is necessarily something of a compromise; and that the further study of the earth's movements—of the earth, that is, as a planet in the solar system—may be found of very great interest.

*The Passage of Sunlight and Heat through the Atmosphere.*—From the sun we derive heat and light, and all that follows from that. It is no matter for wonder that the sun has always been the god of so many heathen peoples. For us it is important to understand the effects of the varying altitude of the sun at different latitudes and seasons. A simple figure shows that the amount of the sun's light

and heat or radiant energy falling vertically on one square mile of the earth's surface, when the sun is at the zenith, will cover two square miles when it falls at an angle of  $30^\circ$ ; therefore in the second case the radiant energy received at any point is only half what it is in the first. Between the tropics the sun is at the zenith over every latitude twice in the year; outside the tropics it is never at the zenith: thus in a given time (say, a year) more radiant energy is delivered to the part of the earth between the tropics than to the

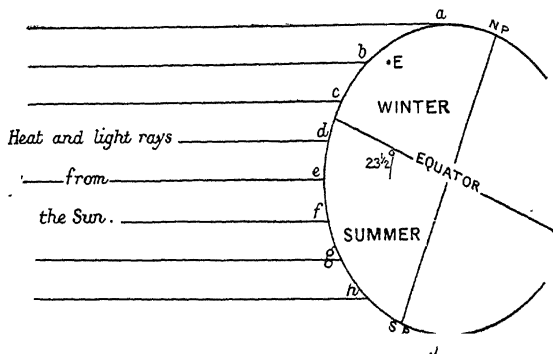


FIG. 134. The 'slope' of the Sun's rays at different latitudes.

parts outside them, and the highest latitudes receive the least. Moreover, the sun's rays which pass slantwise through the atmosphere must pass through a greater thickness of it than those which fall vertically, and therefore more of their energy is absorbed by the atmosphere.

On the other hand, light coming from the sun (or the moon or any star or planet) falls directly from the zenith, but is bent by refraction if it reaches the atmosphere slantwise. The effect of this is that the sun appears higher in the sky than it really is. Thus the daily period of sunlight is lengthened; only by about four minutes at the Equator (compare the table on p. 399), but by hours, increasing to days, in the higher latitudes where the rays always fall slantwise; indeed the 'midnight sun' is visible at midsummer for some distance outside the Arctic and Antarctic circles.

## XII. THE MAP

WE have made use, in the previous sections, not only of the globe, but of the map in hemispheres. The map is one of the foundations of geographical study, and before going into further description of the earth, the subject of map-making and map-reading must be thought of.

*A Flat Map of a Curved Surface.*—When we set out to make a map of the whole earth's surface, or of any large part of it, we are met with the difficulty that we cannot draw an exact representation of the curved surface of the sphere on a flat piece of paper. A sheet of paper will not fit over a hemisphere, for instance ; it tears or folds if you try to make it fit. The drawing of the curved surface on the flat map may give one of these results :

- (1) it may show all directions correctly, so that a line drawn from any point to any other gives what is really the angle between the direction so shown and (say) true north or south :
- (2) it may give an equal value all over to areas ; this means that if we draw two equal small circles anywhere upon it, each represents the same number of square miles of the surface ;
- (3) it may show distances exactly, between any two points.

No map can do more than one of these things.

This is not so serious a difficulty as perhaps it sounds. It is easy to fit a sheet of paper over a small part of a sphere without its folding or tearing. This suggests that such a part might be mapped on a flat surface so that the map should be right in one of the above ways and nearly so in the other two ; and so it is. But when we come to maps of hemispheres, or of the whole world, it is necessary to be careful in reading them, as will presently appear.

*Map-Nets.*—The foundation of a map is the network of meridians and parallels, which are drawn in various ways according to various mathematical methods. The way in which these lines were drawn for any particular map gives us the ' projection ' of the map (a term which, by the way, is not always, as applied to maps, correct in the mathematical sense ; but it is customary in geography).

*Perspective Projections.*—Without going into the mathematics, which is not our business here, we can get a general idea of what

map 'projection' means from a few simple illustrations. There is a group of map-networks called perspective projections. Supposing that we place a sheet of paper  $AB$  flat on a table, and a globe upon it, as in fig. 135, the globe will touch the paper only at one point,  $X$ . If, then, we wish to project any other points on the globe on to the paper, let us suppose that we are looking at the point from inside the globe, at  $C$  (centre), or from its surface opposite to the paper at  $S$ , or from an infinite distance away, at  $I$ . From the point of view

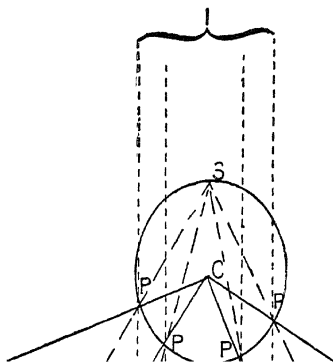


FIG. 135. Perspective projections.

$C$ , or  $S$ , or  $I$ , a straight line is drawn to each point, such as  $PP$ , to be 'projected', and produced to the paper. Lines drawn from point  $C$  give a greatly distorted projection called gnomonic, which is not commonly used, except by sailors, because a straight line drawn on it between any two points marks the shortest way between them, or what is called the great circle course (p. 396). Lines drawn from point  $S$  give a projection called stereographic. Lines imagined to be drawn from an infinite distance—so far away that the lines are parallel and not diverging—would give a kind of picture which is not of much use for a map of the world. It is easily seen from the diagram how much distortion between the globe and the paper will take place with these projections. The distances of the points one from another, as projected on to the paper, are nothing like proportionate to their distances apart on the sphere.

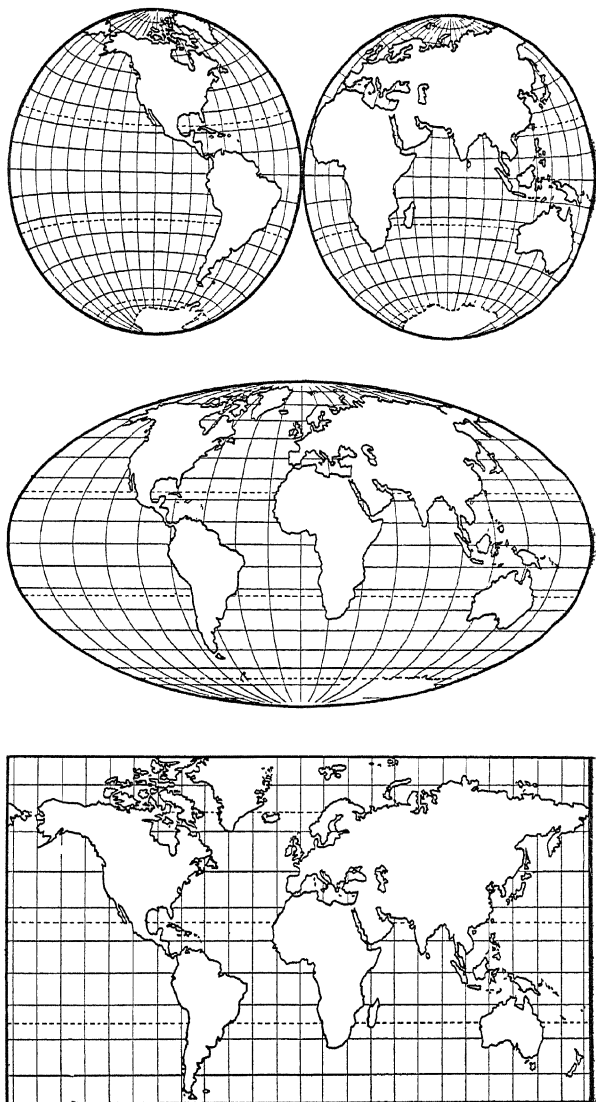


FIG. 136. THE WORLD AS IT APPEARS ON VARIOUS 'PROJECTIONS.'



*Cylindrical Projections.*—We may suppose our sheet of paper to be wrapped round the globe in the form of a cylinder, and points projected upon it by one of the methods described, the network and the outline map drawn accordingly. The cylinder will then unroll and lie flat, and we have a cylindrical projection. There are such projections, which show the surface of the earth in a rectangle, and obviously if the paper touches the globe around the Equator, the poles cannot be projected on to it, for the line from the point of observation to either of the poles, if produced, would be parallel to, and would never meet, the paper. Rectangular maps are common, and useful in many ways. One of them is used in this book to show the world as a whole, which within the space of a page it does on a larger scale, and so more clearly, than a pair of hemispheres do. Another rectangular map, commonly seen, is that on what is called Mercator's projection, which, however, is not a cylindrical projection. This shows direction or compass bearing correctly by means of straight lines joining any two points, and it was really invented, in 1568, to enable sailors of those days to chart their courses from point to point in the simplest possible way. In this map, as in the projection of the world-maps in this book, the meridians appear parallel instead of curved and converging, as they really do, upon the poles; obviously, therefore, the outline must be very badly distorted in higher latitudes. For example, Greenland, which has an area of about 830,000 sq. miles, looks very much bigger on Mercator's map than India, the area of which is really about  $1\frac{3}{4}$  million sq. miles. One must not take ideas of the relative sizes of countries from this sort of map. Our world-maps distort areas less badly, but do not show direction quite correctly.

Another fairly common map of the world shows it in an oval shape, as if two halves of one hemisphere were fitted round the other, one on each side, the Equator being twice the length of the central meridian. This is an 'equal area' map, but the ugly distortion of outline in some parts is obvious.

*Conventional Projection.*—The map of the world in hemispheres is often drawn on the globular projection, which is a 'conventional' projection, as giving simply a fair 'picture' representation of a hemisphere, without any very serious distortion, but without any correctness of area, or direction, or distance, all over. It is easily

understood. The Equator and the central meridian are equal straight lines crossing at right angles, the point of crossing being the centre of the circle representing the meridians bounding the hemisphere. The Equator is divided into equal parts for as many meridians as it is intended to draw, and these are drawn as arcs of circles passing through the points of division, and through both poles.

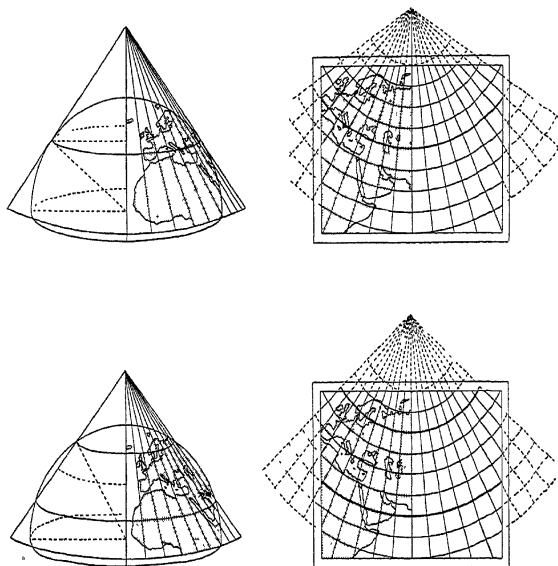


FIG. 137. Diagrams showing the principle of two conic projections. In the first, the imaginary cone touches the sphere along one parallel; in the second, it cuts the sphere along two parallels.

The central meridians, and the bounding meridians, are divided into equal parts for as many parallels as it is intended to draw, and these are drawn as arcs of circles passing through these points of division.

*Conical Projections.*—There is a series of projections known as conical. In the simplest form, the parallels are concentric circles, and the meridians are radii of those circles, equally spaced. The sheet of paper on which a projection is drawn in this way, is sup-

posed to be bent so as to form a cone. This simple principle is modified in various ways, so that the parallels may not always be straight lines. But maps of areas smaller than hemispheres are usually on some form of conical projection.

*Scale.*—The scale, on all maps in which the distortion of distance is not too great, is shown by a line marked according to the number of miles represented by it, or by divisions of it. Sometimes kilometres, and nautical miles, are given as well as statute miles. The scale is expressed in either of two ways.

(1) That any length upon the map represents a certain fraction of that length upon the ground. Let us say that the fraction is one millionth; then the scale would be written as 1 : 1,000,000 or 1 : 1M.; we should call the scale 'one to a million' and it would mean (roughly) that the area represented by the map is a million times as big as the map itself. This is called the natural scale.

(2) Many English maps are drawn so that a certain number of inches on the map represents one mile on the ground, or that one inch represents one mile, or a number of miles. Such scales are called artificial scales. When there is such a scale, the natural scale is also often stated: thus, let the scale be an inch to a mile; there are 63,360 in. in a mile; therefore the natural scale is 1 : 63,360.

*The Ordnance Survey.*—The principal countries of the world have surveys carried on by their governments. That in Great Britain is called the Ordnance Survey. It publishes maps of certain towns on the big scale of 10 ft. to a mile (1 : 528), for use only where great detail is required, in connexion with the mapping of properties, and so forth. For such purposes also the map of the whole country on the scale 1 : 2,500 (nearly 25 in. to the mile) is also mostly used. Next comes the map at 6 in. to a mile (1 : 10,560), with less, but still great, detail, and then the series of maps, whether produced by the Ordnance Survey or based upon it, which are used extensively by people travelling. Thus the maps at 1 inch to a mile, or even  $\frac{1}{2}$ -inch to a mile, show enough details of roads, paths, and other features to be used on a walking tour. A scale of  $\frac{1}{4}$ -inch to a mile serves well for main roads, and the principal roads can still be shown well on scales of an inch to 8 or 10 miles, but these scales are too small to show all roads clearly, as well as railways, towns, and villages; the relief of the land, and so forth. Then we come to atlas maps, in

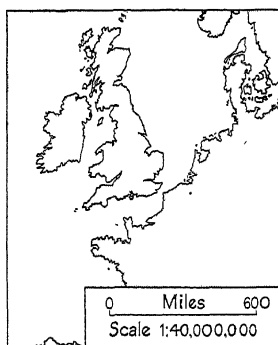
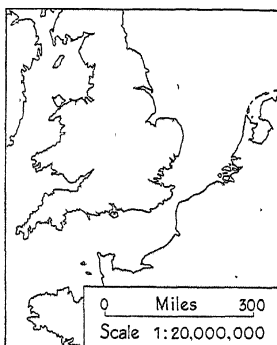
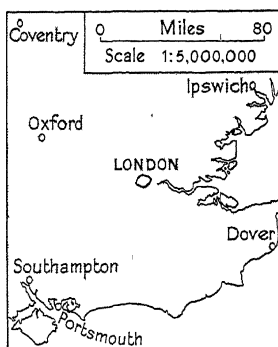
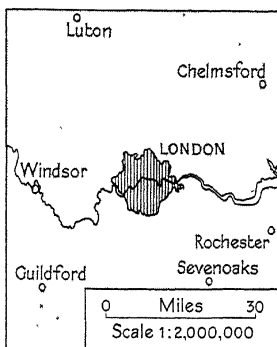
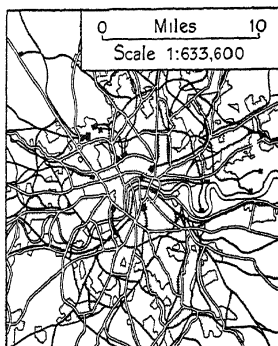
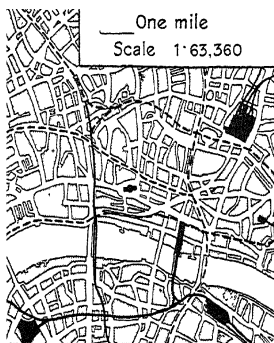


FIG. 138. EXAMPLES OF VARIOUS SCALES. The top left-hand map shows a bit of London, with St. Paul's Cathedral in the middle; the next shows most of London, and London is in the middle of the others.

which the scale of each map has to be suited to the area shown ; thus we may have England on a scale of 1 : 2M., Europe at 1 : 20M., but Asia at 1 : 40M.

*Simple Surveying.*—The best surveys, such as the Ordnance Survey, are done with instruments (theodolites, &c.) of high precision. But it is easy to get a general idea of the method of surveying a country, and even to make a very fair map, with simple instruments, and for anybody with a taste for making things it is interesting too.

The plan of a room and the furniture in it, or of a small garden and the flower-beds in it, is made most readily by means of a series of measurements with a tape-measure, after deciding what the scale of the plan is to be. But in making a survey it is not always necessary to be continually measuring. A 'base-line' must be measured, however, and that with the greatest accuracy possible, and on a level surface from which there is a reasonably wide view. The instruments we are going to use are a plane-table, a spirit-level, a compass, and an alidade. A plane-table, simply described, is a drawing-board fixed horizontally on a tripod (camera-legs, for example). This is set up exactly over one end of the base-line, and the board must be set level by means of the spirit-level. A line to represent the base-line should be drawn on the paper fixed to the drawing-board, at the scale on which the map is to be made, and in a convenient position on the paper, having regard to the area of ground to be mapped. Suppose we are at point *A* at one end of the base-line ; a rod should have been set up at the other end (*B*). We now use the alidade. This is a flat ruler with a pair of sights, one at each end, on the same principle as the sights on a rifle. The alidade is centred upon the point *A*, and the plane-table is set so that the sights bear on *B*, with the ruler truly along the line *AB*. Then the compass (if possible one called a trough compass in a straight-sided case, so that a line may be ruled against its edge) is used to enable the line of north and south (*NS*) to be drawn on our map. Now, always resting the alidade against the pin, we turn it so as to take sights upon any conspicuous objects—say a tree, a church spire, the apex of a barn (*C*, *D*, *E*), ruling lines along the edge of the alidade pointing toward each of these objects. Now we go the other end of the base-line (*B*), and set the board by compass and by a back-sight upon *A*, and sight also upon *A*, *C*, *D*, *E*. The lines drawn from *B* to *C*,

$D, E$  will intersect those drawn toward these points from  $A$ , and it follows that the points of intersection should show the distance as well as the position of these objects on our map without the need of measuring the distances to them. So now we can set up the plane-table at  $C$ , and at  $E$ , as if we had a base-line measured between them, check the position of  $D$ , locate a new point  $F$ , and so on. And let it be supposed that the base-line  $BA$  represents half a

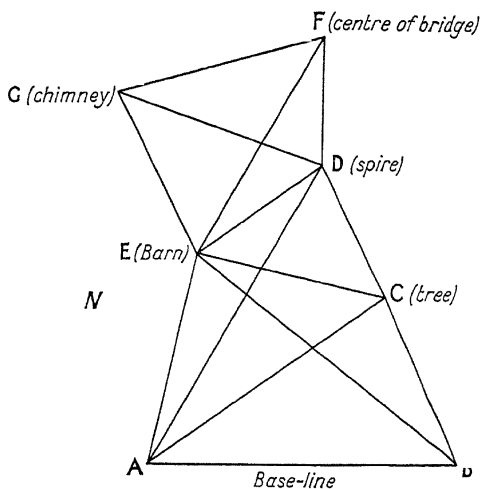


FIG. 139.

mile, and that point  $G$  is visible neither from  $A$  nor from  $B$ . Nevertheless the map tells us that  $G$  is half a mile from  $A$ , and three-quarters of a mile from  $B$ .

*Triangulation.*—Such is a very simple explanation of what is called triangulation, which is the basis of topographical survey. In a first-class survey the primary or chief triangulation would consist of triangles with long sides, using only permanent and very well-marked points to sight upon—if necessary, structures built for the purpose, not trees or things which might disappear at any time. Using the points of this primary triangulation, there would be a second system of smaller triangles within it; perhaps a third within

that, until the stage is reached at which details are sketched in on the map by eye, without triangulation or measurement. In country where the methods of triangulation cannot be followed, such as forest land where distant points cannot be seen, or when a traveller passes over a route without time to make a triangulation, there is a method known as traversing, which necessitates both calculating the compass

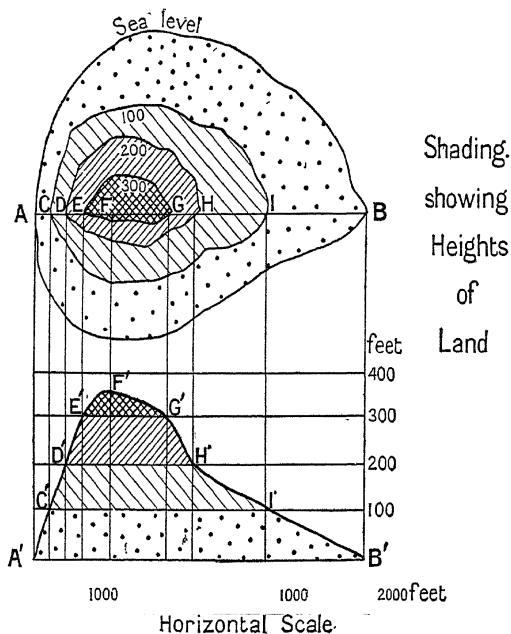


FIG. 140. SIMPLE CONTOURED MAP AND SECTION.

bearing and measuring the distance between every two points. Also, photography from an aeroplane may be used to fill in the details of a survey map.

The goodness of small-scale maps, from reductions of the original survey down to atlas maps, depends on the skill with which the main features of the country are taken from the survey, while at the same time the map is simplified by leaving out details, so far as the scale makes this necessary.

*The Mapping of Height and Slope.*—But we have not yet taken account of the ways of measuring the height and slope of the land, and of showing this on our maps. Height can be calculated by triangulation, as in fig. 139, but vertically and therefore not with a plane-table: it can be done roughly with an instrument called a clinometer. And there are methods of calculating the height of any point, approximately, without its being a point in a triangulation system, which are based upon atmospheric pressure and the boiling-point of water. In order to express the height of land we need a datum or given level which is the same (or practically so) everywhere; therefore the mean or average level of the sea is taken, and so heights of land are usually stated to be so many feet above sea-level.

*Contouring.*—For representing height and slope on the map, there are two principal methods. One might mark every point of which the height is known, and write the number of feet against it. But this (if a great number of heights had been measured in the piece of country mapped) would crowd the map, and would not distinguish clearly between high and low ground. If we draw a line through every point which has a certain height, we have a contour line; if we go on doing this for certain selected heights, we have a contoured map, and if we use colours or tints in layers to show different heights we can get at a glance a general idea of the relief of the surface. In our layer-coloured contour-maps shades of green are usually used for the lower land and shades of brown or red for the higher (sometimes with white, or a blue tint, for very high summits). It can easily be seen that when the contour-lines are close, the slope must be steep, when far apart, gentle. We can illustrate this by

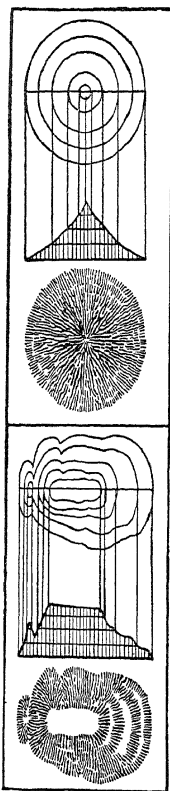
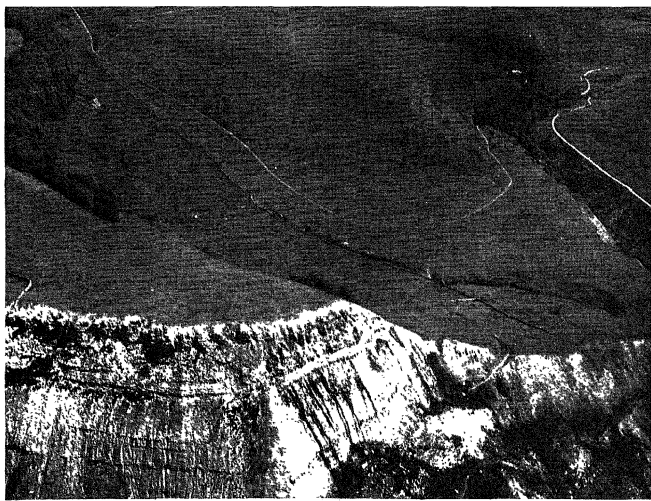
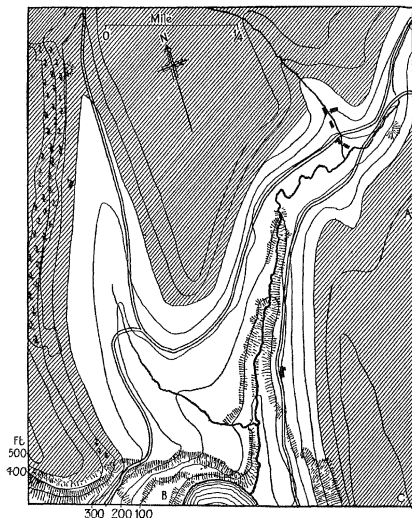


FIG. 141. Above, contours, section, and hachures of a peaked hill with steeper slope at top; below, the same, of a table-topped hill.



FIG. 142.

This is a map of the country seen in the facing photograph from the air (which, however, does not cover the triangle indicated by the points ABC in the south-east corner of the map). The ravine and cliffs in the south, the tracks, the farmsteads, and the woods may be seen, and the relation of the contours on the map to the slopes in the picture may be traced. Based upon the Ordnance Survey Map, with the sanction of the Controller of H. M. Stationery Office.





making a section from the contours. Sections from contours, however, can only give a general idea of the 'lie of the land': the more contours there are, the more accurate a section based on them becomes, but it can never give a perfect profile. Sections of the land-surface have usually to be drawn on a much larger scale for height than for distance, otherwise the heights would hardly be seen; the highest mountain is no more than a pimple on the earth's face, as compared with the size of the earth itself.

*Hachuring*.—The second principal method of showing the relief of the land on a map is by drawing stream-lines, so called as representing the general direction streams would take down the slopes. Being drawn along the slopes, they cross contours; the steeper the slope, the closer they are drawn, as contours are. When well drawn, they give something near a picture of the relief. This method is usually called hachuring. Another common 'picture' method is that of using shading, usually brown, occasionally buff or green, darkening as the slope becomes steeper. There are simple methods of hachuring, which are sometimes compared to hairy caterpillars, and are not good. The system used in some of the key-maps in this book (for example, fig. 27), of drawing a black line along the general direction of a mountain-ridge, is used merely to show that there are mountains, as a guide to their fuller study in the atlas.

*Conventional Signs*.—A map is not a picture, and for some of the details conventional signs must be used. The principal conventional signs of the Ordnance Survey are illustrated in fig. 144. With a knowledge of these and some practice in understanding contours it becomes possible to read a good map as one might read a book and look at the pictures in it—and with as much, but a new, interest.



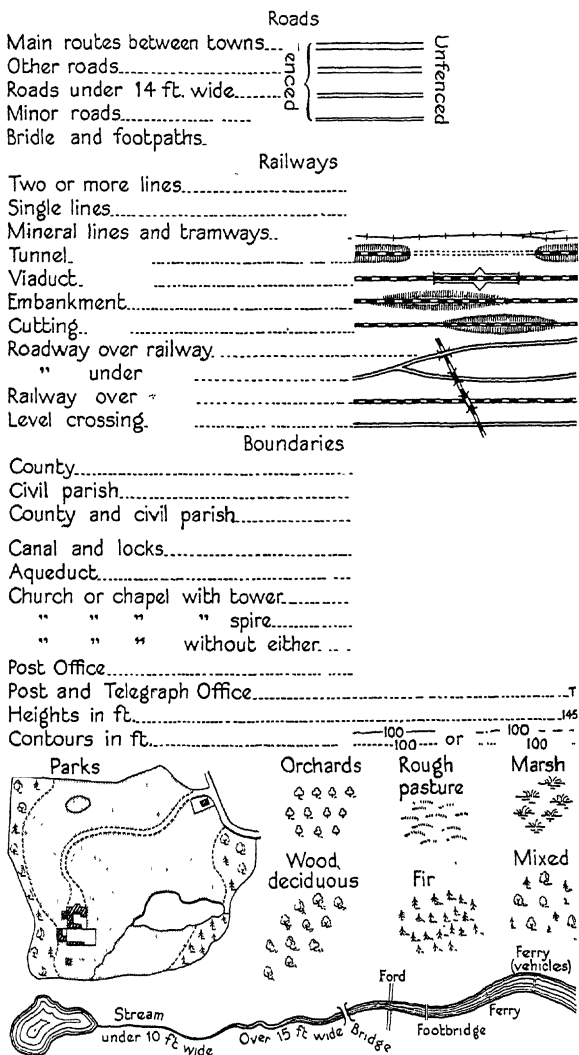


FIG. 144. ORDNANCE SURVEY CONVENTIONAL SIGNS.

### XIII. DIVISIONS OF THE EARTH'S SURFACE

THE earth is sometimes said to consist of three parts—the lithosphere or sphere of rock; the hydrosphere, or sphere of water, which covers a great part of the surface; and the atmosphere or air which surrounds both. 'Land' is that part of the lithosphere which is not covered by water; 'the sea' is the main body of the water of the hydrosphere. The surface of land and sea consists as to less than three-tenths (29 per cent.) of land, and more than seven-tenths (71 per cent.) of water.

While the globe and the atlas (especially the atlas) must always be at hand in geographical work, it is very useful to memorize at least a simple picture of the earth—to have a map in the mind's eye. In this chapter, therefore, we shall try to pick out and repeat from the description of the World in Part I a few big features of the earth's surface which, set in order and relation one to the other, may be used to make the picture.

*Distribution of Land and Sea.*—If we look at a hemisphere of which the central point is on the meridian of Greenwich, and about the latitude of  $45^{\circ}$  N., we can see the whole or most of four out of the seven continents into which the main land-masses are divided—Europe, Asia, Africa, North America and South America. And in this hemisphere land and sea are shared about half-and-half. But let us look at the opposite hemisphere—that in which the central point is the antipodes of the first, that is the opposite to it on the other side of the globe, on the meridian of  $180^{\circ}$ , and in lat.  $45^{\circ}$  S. Here only two of the smallest continents are seen wholly, Australia and the land about the south pole, or Antarctica; and by far the greater part of the rest of the hemisphere is covered by sea.

An atlas map of the world in hemispheres, however, is usually drawn so that the great circle forming their circumference is that of the meridians of  $20^{\circ}$  W. and  $160^{\circ}$  E., or thereabouts, because these do not cut through any important land.

In the eastern hemisphere we see one great mass of land which is often called the Old World in distinction from the New World, or America, in the western hemisphere; because the history of mankind goes back for thousands of years in the Old World, but for only a few hundreds in the new. This great mass, at first sight, is divided

very clearly into two parts by seas branching from two of the great ocean basins. The one part consists of the continents of Europe and Asia ; Europe the western division, Asia the eastern ; Europe by far the smaller, and not everywhere divided from Asia by very clear natural lines. For that reason, it is sometimes convenient to name this whole part of the great land-mass Eurasia. Eurasia lies entirely north of the Equator. On its south-west side, the Mediterranean Sea and the Red Sea cut deep into the land, so that there is only a narrow strip of land, or isthmus, between them. This, the isthmus of Suez, connects Eurasia with the continent of Africa, which is the other part of the great land-mass of the eastern hemisphere. Africa extends south of the Equator to about  $35^{\circ}$  S., occupying the western side of the eastern hemisphere. On the eastern side, southward from the south-east of Eurasia, there is an archipelago (or island group) of great islands forming the Malay Archipelago, sometimes known also as the East Indies. South-east again, there is the island, so large as to be called a continent, of Australia. So that we see in the eastern hemisphere the land arranged in something of the form of a horseshoe, with the open end toward the south, and the front, which is the continent of Asia, toward the north. Within the horseshoe is the Indian Ocean ; to the east of the horseshoe is the western edge of the Pacific Ocean ; to the west of it, the Atlantic Ocean. On our hemispheres we do not see either the Pacific or the Atlantic ocean as a whole. The globe serves us better here, as it can be set in any position.

In our western hemisphere, the continents of North America and South America, joined by an isthmus, Central America, extend from within the arctic circle to  $55^{\circ}$  S. Their relative position was noticed in Part I (p. 291) : practically the whole of South America lies east of  $80^{\circ}$  W. long., but only about a fifth part of North America, and the narrowest part of Central America, the isthmus of Panama, runs east and west. The archipelago of the West Indies lies between the south-east of North America and the north-west of South America, in a relation to them something like that of the East Indies to Asia and Australia. To the west of the Americas, we see the vast expanse of the Pacific Ocean, with the large islands of New Zealand in its south-western part, not far from the centre of the 'water hemisphere' which we looked at before (p. 422). In the north-west part of the

hemisphere we see the north-eastern extremity of Asia, where that continent approaches most closely to North America.

*The Polar Regions.*—The arrangements of land and sea in the arctic and antarctic regions are exactly opposite. The North Pole is in an ocean basin (that of the Arctic Ocean) surrounded by a broken rim of land. The South Pole is on the continent of Antarctica, which is surrounded by unbroken sea. This sea is sometimes called the Great Southern Ocean, and the Atlantic, Indian, and Pacific Oceans, defined as nearly as they can be between the continental land-masses, are taken to open out of it.

*The Continents—Europe and Asia.*—The great physical features of the land-surface, such as may be seen by taking a general survey, and not a close inspection, of the globe or physical map of the earth, may be set down as follows. In northern Eurasia, great plains are seen; they extend from western Europe, where they are narrow, almost across the continents of Europe and Asia. The Ural Mountains, which are taken as part of the boundary between the two continents, and lie nearly along  $60^{\circ}$  E. long., are not high, and they do not break the plains for their full width, which is here at its greatest, extending from the Arctic coast to about  $36^{\circ}$  S. Next, across the whole of southern Europe and into central Asia and beyond, there extends a series of high mountain systems and plateaus. They are not continuous, being separated by deep depressions; but they form on the map a well-marked belt, to which belong the Pyrenees, Alps, and Balkan mountains in Europe, the Caucasus and the ranges and plateaus of Asia Minor and Iran in south-western Asia; the Pamir, the Himalaya with the highest summit of the earth's surface, the huge high central plateau of Asia with many other mountains rising from it, and lower ranges extending from it to the north-eastern extremity of the continent. Wide plains, though much smaller than that of the north, are seen in eastern Asia (China) and at the southern foot of the Himalaya mountain-system, in India. The coastline of Eurasia is seen to be very irregular, and projects a series of great peninsulas<sup>1</sup> into the

<sup>1</sup> A peninsula means strictly 'almost an island', but it can hardly be said that Scandinavia, India, and the rest are 'almost islands'. The word is applied to any piece of land whose coastline is very much longer than the land-base along which it is attached to the continent to which it belongs.



surrounding seas, west, south, and east. In north-western Europe is the mountainous Scandinavian peninsula; in south-western Europe the Iberian; in southern Europe Italy and the Balkan peninsula project into the Mediterranean Sea. In south-western Asia the peninsula of Asia Minor reaches westward, that of Arabia southward. The triangle of India points south from the base of the Himalaya mountains. The Malay and Indo-China peninsulas jut out from south-eastern Asia, the first reaching nearly to the Equator. Korea projects from the east coast, Kamchatka from the north-east. Many islands lie off the coasts: Great Britain and Ireland off western Europe, Ceylon off the end of India, the Malay Archipelago off south-eastern Asia, the islands which make up Japan off eastern Asia. Branch seas and inlets from the great oceans deeply penetrate the land, and we have found this a geographical fact of the very first importance, in connexion with trade and communications by sea.

*North America.*—If we look next at North America, some points are seen in which it is like Eurasia, though it is smaller. The greatest breadth of both is toward the north. The Arctic lands are generally low in North America, as in Eurasia. The coasts are broken, though not so much so as in Eurasia, and there are many islands off the coasts, though not so many as off those of Eurasia, except to the north-east where there is a vast Arctic archipelago extending toward the huge island of Greenland. But apart from the Arctic lowlands, the arrangement of high and low lands in North America and Eurasia are not the same. In North America a mountain belt extends along the whole western side of the continent; a lowland belt extends right through its middle from the Arctic to the northern tropic, and a mountainous or hilly region is found in the middle east, not so high or extensive as that in the west.

*The Southern Continents.*—The same arrangement is seen in South America—the high mountain-belt of the Andes rises in the west; to the east of this, low plains extend through the length of the continent, and the easternmost part of the continent is a mountainous or hilly region, but not so high or extensive as the region of the Andes.

The coastlines of the southern continents (South America, Africa, Australia) are very regular in comparison with those of Eurasia and North America. In Part I (p. 338) we compared South America and

Africa, which are somewhat alike in their shape, broad to the north, tapering to the south, and in the smoothness of their coastlines ; and we found another comparison, between the basins of the two great rivers, Amazon in South America, Congo in Africa, which are crossed by the Equator, and open to the sea on opposite sides of the Atlantic Ocean. The physical likeness ends here, for Africa is of plateau form in large part ; it has no very extensive low plains, nor has it any great mountain-belt to be compared with the Andes. Australia, however, has something like the American continental form, reversed in direction ; its mountain belt is in the east, its great plains behind them toward the centre, while there are hilly districts in the west.

*The Oceanic and Inland Drainage Areas.*—This general survey reminds us that the Pacific Ocean has a vast ring of mountains around it: the mountains of Japan and north-eastern Asia ; the western mountains of North and South America, the eastern mountains of Australia, the high ranges of New Guinea (the great island north of Australia), and the islands of the Malay Archipelago, which are generally mountainous. This suggests that few great lowlands open upon the Pacific, and therefore that the area of lands whose rivers flow into the Pacific must be small in comparison with those draining to other oceans ; and so it is. Roughly a third of the land surface of the earth drains through its rivers to the Atlantic Ocean and its branch seas ; to the Arctic a sixth ; to the Pacific only a seventh ; to the Indian Ocean (which is much smaller) an eighth. There is more than a fifth of the land-surface from which the rivers do not run into the oceans, but belong to systems of inland drainage. In parts of this area, indeed, there are few rivers or none, for it includes most of the great dry deserts of the earth, and the biggest of these form a broken belt extending from the north of Africa to central Asia. But areas of inland drainage are not necessarily desert : there is for example the region of eastern Europe drained by the great river Volga, which flows into the Caspian Sea, an inland sea, not connected with any ocean.

## XIV. THE LAND

### THE SHAPING OF THE SURFACE

*The Interior of the Earth.*—Of the three spheres into which, on p. 422, we divided the earth, one, the lithosphere, may itself be divided as between its crust and its core. The distance from the earth's surface to its centre is about 4,000 miles. The greatest depth of the ocean yet discovered is nearly six miles, which is somewhat greater than the elevation of the highest part of the land above sea-level. The atmosphere is probably at least 80 to 100 miles thick. These figures are sufficient to show that the three 'spheres' are very thin compared with the great mass of the core. The materials forming the core are very dense, it is under great pressure, and its temperature is high. In a coal-mine temperature increases on the average about  $1^{\circ}$  F. for every 60 ft. of descent, and in the deepest mines the miners find it difficult to work without artificial means of cooling the air.

When volcanoes erupt, sometimes molten rock (magma) forces its way through the crust, and this might lead us to think that the interior is in a molten state. But this is not conclusive proof. Owing to the release of pressure on the rock, it may become molten when it gets to the surface, or there may be pockets or reservoirs of molten material somewhere beneath the crust. The whole earth behaves more like a solid ball than like one filled with liquid, and the specific gravity (i. e. the relative weight) of the whole earth is greater than the specific gravity of the materials forming the crust. It is usually held that a central core of the earth, of about a fifth of the diameter of the whole, is probably composed of metallic substance (nickel-iron), and, despite its high temperature, as rigid as steel is at the surface of the earth. The outside layer is supposed to be some 40 miles thick, and its visible surface is the land-surface as we know it. This layer is not all of the same composition, and it is believed that the continental land-masses are floating, as it were, in a heavier material which underlies them and the oceans, somewhat as icebergs float in water.

*Crust Movements : Continental Blocks and Oceanic Depressions.*  
—It is with the surface of the earth, however, that we are more

directly concerned because Man lives on it. The conditions of life on the earth result from the combined influences of all three of the 'spheres', and in their effects they interact one on another. Matter forming any one of them may change its state and become part of another. For example, water in the form of vapour passes into the air; dust, which rises from the land, is present in the atmosphere; certain gases in the air are taken up by the land and sea; and water in the form of rain, hail, and snow, passes from the air to the earth, and some of it finds its way back to the oceans taking with it material from the land. These changes play important parts in the shaping of the land-surfaces. Certain forces have caused some parts of the lithosphere to be elevated and so form land areas or blocks, while, naturally, the water on the surface has drained into the low areas between, to form oceans. The contour of an ocean floor is something like a vast plain, with a few deep depressions in it. Movements have caused the surface of each continent to become wrinkled, so that some parts are much higher than others. The surface of the earth is still subjected to such movements. It is extremely difficult to make observations to prove this, but in certain parts of the earth a lifting movement has been recorded over small areas. It is even more difficult to prove any movement of depression, but the shapes of some coastlines indicate that the land has sunk and allowed the sea to cover parts of it. These movements take place very slowly, the changes in the level of the land being only a few inches in a century. But over long ages they have produced great changes, and geology teaches us that many parts of the earth which now are land, once formed parts of the ocean floor; in fact, it is probable that few (if any) areas of land have remained permanent throughout geological time. In many parts of England, for example, we find the remains of marine animals, especially in certain materials of the crust, such as chalk and limestone.

It would seem then, that at different periods in the life of the earth, there have been great upheavals of the crust which have resulted in the building up of continents and the breaking down or depression of areas to form ocean basins. Besides these, smaller changes have taken place—and probably are still going on—which have given the continental surfaces their main features. We have found, on examining the structure of continents, that distribution of highland

and lowland is not haphazard, and that it is possible to arrange the mountainous parts into systems.

*The Sculpture of Land-surfaces.*—These main features of the continents are determined by movements of the crust, but the form of the land is modified in various ways. Changes are caused by earthquakes and by the action of volcanoes (and these again are connected with earth movements): greater changes are produced by various sculpturing processes. The surface of the land is worn by rivers and other agents and the edges of the land are worn by the sea; thus material is removed from one place and deposited in another. In their work, these agents receive help from the atmosphere. Changes of temperature, wind, rain, and frost help to loosen surface material and so it is more easily removed.

*The Substance of Rocks.*—These processes of weathering, denudation, and deposition, have not the same effect all over the surface. The climate of any region to a considerable extent determines the nature of the denuding agents at work. But in places where the agents are similar, we find that there is a great variety of land-forms, and this is due to the fact that the materials forming the land differ one from another in various ways, some being more durable than others.

The lithosphere is composed of 'rocks', a term used to include all materials whether they are hard or soft. In the ordinary way, we use the word when referring to stony or hard masses, but in geology loose sand is considered a rock in the same way as granite is. There are many kinds of rock and quite a large number are easily distinguishable; few people are unable to distinguish chalk from granite, and those who possess gardens will know the difference between sandy soil and clay. Some rocks are more resistant than others and therefore less easily worn, which means that some parts of the land stand up above the level of other parts. For example, sandstone and sand are more easily broken down and washed away by water than such hard rocks as granite. Again some rocks are easily soluble in water, others less so, and others are nearly insoluble; so that the influence of rain and running water is not always equal. Lime and salt are the materials most commonly dissolved out of rock by water. Besides these differences of resistance and solubility, rocks vary in texture. For example, a piece of flint is composed through-

out of the same hard substance—that is, it is homogeneous—whereas another stone may consist of a number of hard grains held together by some soft substance. Rocks are composed of particles of minerals, which are mixed in various ways. From the foregoing example, it will be seen that a rock may be formed of one mineral only, but generally two or more minerals help to form it. Examples of rock-forming minerals are quartz, feldspar, mica. Usually the soil consists of a mixture of rock debris, but all soils are not alike. We speak of heavy and light soils, also the colour varies. Naturally, the character of the soil is determined to a large extent by the kind of rocks beneath, but very often mixture with materials brought by rivers or other agents has taken place, and, to some extent, composition has been changed by artificial means during cultivation.

*Volcanic Rocks.*—Besides the differences in rocks already mentioned, there is another which cannot be seen so easily when examining hand specimens ; this is the structure. In order to understand this, it is necessary to know something of the origin of these materials which now form the land. It is according to the mode of origin that rocks are classified, and we divide them into two main classes. Igneous rocks (Latin, *ignis*, fire) are so called because at some previous time they have been in a molten state. This molten material may have reached the surface from the interior of the earth as magma, where it would spread out in sheet form and cool fairly quickly to form lava ; or it may have failed to reach the surface and so cooled more slowly. In cooling, it solidifies and the different minerals contained in it form crystals. The lava cools quickly and therefore the crystals are very small and, as a rule, cannot be seen, except through a microscope. An example of this volcanic rock or lava, as it is called, is basalt, such as appears in the Giant's Causeway in Ireland and in some of the western islands off Scotland (Part I, pp. 30, 66). In places where, owing to wearing away of the surface, rocks which have cooled slowly are exposed, we find that the crystals are larger or coarser, and can be seen easily. An example of a coarsely crystalline rock is granite.

*Sedimentary Rocks* have been formed, in some instances, from material worn from the land and deposited in the oceans and other waters. Besides this kind of sediment, another kind is formed by the shells and skeletons of marine organisms which, when elevated to

dry land, forms limestone. Coal, lignite, and peat are formed from the remains of plants.

These rocks are first laid down in horizontal strata (layers or beds) and are said to be stratified. Often this bedding can be seen on the side of a cliff or along the face of a gravel or sand pit. The very wonderful example seen in the Grand Canyon of the Colorado River in North America has been described in Part I (p. 302).

*The Splitting of Rocks.*—Both igneous and sedimentary rocks have a tendency to break or split in certain directions, and these structural



FIG. 145. Bedding and joints. (Portion of a cliff formed of limestone and shale.)

differences in rocks have an important influence in the shaping of land-forms. As the sediments are deposited in layers, they split easily along planes which are parallel to the bedding. And in drying the sediments shrink and so cause the beds to crack along lines at right angles to the bedding, which produce irregular blocks. These cracks are called joints.

In the igneous rocks joints are formed by cooling, but usually they are more regular than in the sedimentary; for example the basalt of Giant's Causeway takes the form of hexagonal columns. Granite blocks are generally rectangular in form.

*Folding.*—The strata of the sedimentary rocks do not always remain in their horizontal position, and this is the result of the movements of the earth's crust. The changes in the position of beds indicate the kind of movement which has taken place. In some

places, vertical or oblique sections are exposed and so the positions of beds can be seen. They may be inclined at an angle or moved into a vertical position; sometimes they are completely overturned and broken up. The forces which cause these displacements act in two directions. If the direction of the movement is vertical, there is a simple elevation or depression of the surface. If the force acts in a horizontal direction, the beds are compressed and either folded or crumpled. Thus great mountain-ranges are uplifted. The shape of the folds depends, to a large extent, on the amount of

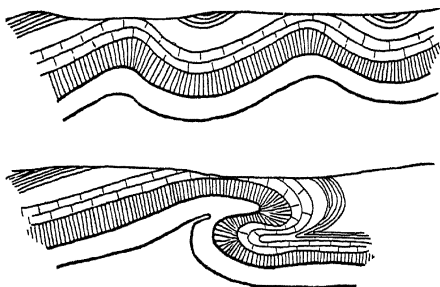


FIG. 146. Sections showing (above) strata or rock beds bent into simple folds; (below) beds bent into overfold.

pressure caused by the movement and on the elasticity of the beds. Some parts of the earth's crust are weaker than other parts and the crumpling takes place in these weak places. Some idea of how this folding takes place may be obtained by taking a piece of cloth of two or three thicknesses to represent the horizontal beds and then pressing inward and sideways with the hands. The cloth ridges up into folds, and if the hands are pressed in to meet these folds will lie one on the top of another. When these beds are overfolded it is easy to see that they will not lie in the same order as when they were laid down as deposits.

*Faults: Rift Valleys.*—Owing to pressure or to tension, breaks or faults are formed which sometimes cause some portions to be pushed or thrust over others. When a fault takes place on a large scale, sometimes a portion of surface is dropped down, and if it should happen that two parallel faults are caused, a strip of country may be lowered



and form a rift valley. We have found examples in the valley of the Jordan and the Dead Sea, in East Africa (Part I, pp. 213, 258), and elsewhere. 'Blocks' of the surface, marked off by rift valleys or faults, sometimes stand up as block mountains. Simple examples are found in the western mountain region of the United States (northern California, &c.).

*Metamorphic Rocks.*—The crust of the earth, then, is subjected to

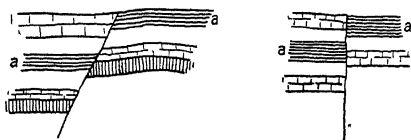


FIG. 147. Fault or fracture, inclined (on left) and vertical (on right). The position of the bed *a, a* (and others) on either side of the fault shows the amount of displacement.

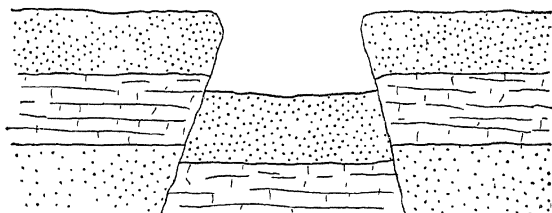


FIG. 148. DIAGRAM OF RIFT VALLEY.

stresses, and as some parts appear to be weaker than others they give way. Owing to heat and pressure the rocks often undergo change, and lose their original character. Such rocks are called metamorphic (a word of Greek derivation, implying change of form). Slates are derived from clay, marble from limestone, and such rocks as gneisses (sparkling) and schists (split), which often occur along the axis of a mountain chain, are derived from various other types of rock.

*Gravity.*—The outside portions of the earth are always pressing towards the centre because of gravitation or weight, and in all probability this weight is not evenly distributed. Most of the material worn away from the land is deposited in the oceans, and if the sculpturing processes went on sufficiently long, the land surfaces

would be planed down and the ocean basins would be filled with sediment. But this final stage is never reached, for crust movement prevents it.

*Earthquakes.*—That some parts of the earth's crust are less stable (or firm) than other parts is suggested by the distribution of earthquakes and volcanoes. For example, the British Isles are not troubled by serious earthquakes or by the eruption of volcanoes, and it would seem that this part of the crust is rigid or in a stable condition at the present time. But conditions have not been the same always, for we have already noticed volcanic rocks in these islands. We find generally that earthquakes are most frequent where folding or faulting of the surface has taken place in recent geological times. For example, during the later part of last century and during the present century earthquakes have caused serious damage in Japan and along the western coasts of the Americas. In some cases there has been serious loss of life by drowning, when an earthquake below the sea has caused big waves to flood coastal districts. Sometimes the vibration is so strong that large fissures are formed in the ground and portions are elevated or depressed. To guard against injuries from falling buildings, in earthquake areas, the inhabitants often build their houses of very light materials; and the foundations of big buildings are laid in a special way to withstand shocks.

The point of origin of a great earthquake may be several miles deep in the earth: the earthquake is felt first at a point on the surface called the epicentre, vertically above that of its origin, from which vibrations spread in the form of waves. These may be felt as slight tremors, or recorded by delicate instruments, thousands of miles away. It has been proved that in many cases earthquakes occur in parts where big faults or fractures in the crust are known to exist. When a fault or thrust plane is formed, as for example in the formation of a rift valley, big blocks are displaced and some time may elapse before they settle down into a firm position. When such a large block slips only a small distance, it will cause a jar and so shake the area around. The falling of the roof of a mine is sufficient to cause a small earthquake. Disturbances, again, often take place in volcanic districts, and sometimes an earthquake is connected with the eruption of a volcano. Usually the shock is felt only locally, and probably it is caused by the volcanic explosion.

*Volcanoes.*—We find that volcanic belts occur near the areas which have been disturbed in recent geological times. A number of active volcanoes are found in Central America, Mexico, and the Andes, while in the Rockies there are many recently extinct. Active volcanoes are found in Alaska, the Aleutian Islands, the Kurile Islands, Japan, and the Philippines. Another line runs through

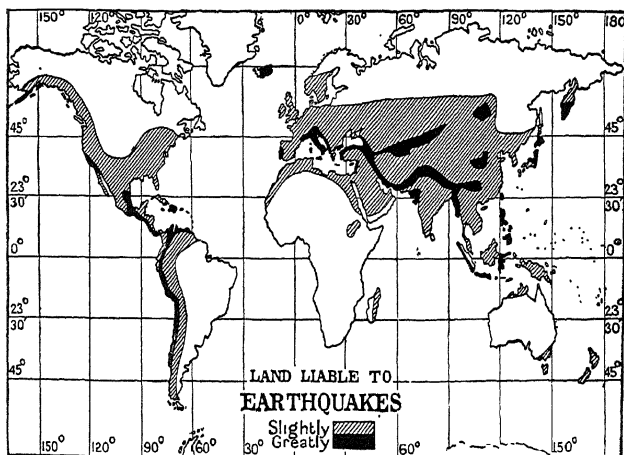


FIG. 149. THE DISTRIBUTION OF EARTHQUAKES. The relationship with the distribution of volcanoes may be seen by comparison with Fig. 150.

the East Indies (Sumatra and Java), passing to New Guinea, the Solomon Islands, the New Hebrides, and New Zealand, and possibly to Mount Erebus on the Antarctic continent.

Many of the islands of the Pacific are formed of volcanic material, and in some cases the volcanoes are still active. In Europe volcanic activity is seen in the Mediterranean region. The well-known volcanoes of Etna, Vesuvius, and Stromboli are still active, but following the belt of folding through Asia, we find only extinct volcanoes. Dead cones are found as far east as Baluchistan but no volcanoes are found in the Himalayas. A short line which runs through some islands of the West Indian group is probably an offshoot from Central America. Other Atlantic islands, also, are of volcanic

origin. Teneriffe, in the Canary Islands, has erupted in recent years, but in most cases activity has long ceased. In East Africa, Mounts Kenya and Kilimanjaro and other heights are volcanic cones.

In the north-west of the British Isles there are areas covered by basalt (lava-flows), and probably a large volcanic area at one time stretched from here toward the north, for at the present time there is activity in Iceland. In many parts of the world extinct volcanoes

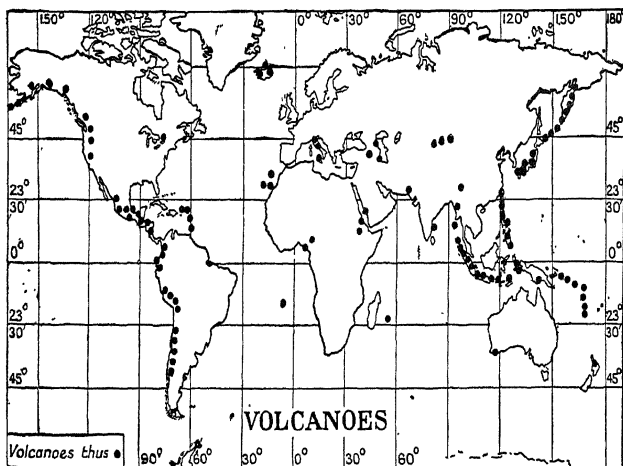


FIG. 150. THE DISTRIBUTION OF VOLCANOES.

are found near mountains and plateaus which are worn-down remnants of great ranges of the past. Cones, some of them perfect in shape, are found in various parts of Europe, for example, the Eifel and Auvergne districts (Part I, pp. 99, 120). In the past, eruptions must have taken place on a much larger scale than they do now, for basaltic lava-flows cover thousands of square miles in the Deccan of India, in the Snake river plains of the United States and in other parts of the world. The lava was not thrown out from crater-like vents, but poured out from fissures. These fissure eruptions are not common to-day, but in 1886, at Tarawera in New Zealand, an eruption took place along a fissure nine miles long.

Most volcanoes take the form of a cone. When an eruption takes

place, much of the material which is thrown out falls near the vent, and in subsequent eruptions material is added to this ; thus a hill is gradually built up. The vent, an opening at the top or side of the hill, is called the crater. The nature of the surface of a volcano depends, to a large extent, on the material which has been thrown out during eruptions. Solid material, condensing steam and clouds of gas, as well as clots of magma, are often thrown out. The magma comes from beneath the crust, and is forced up, by pressure exerted by forces of the same kind as those which cause folding of the crust,

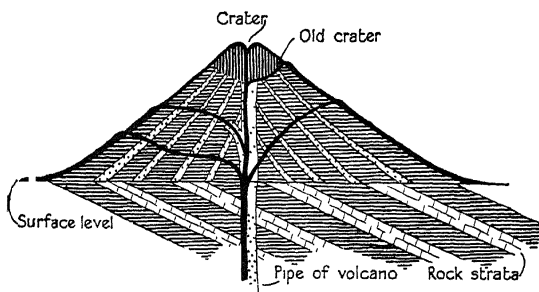


FIG. 151. DIAGRAM OF A VOLCANO.

through pipe-like channels to the surface. From the main pipe branches lead off, and occasionally reach the surface to form small secondary volcanoes, but what is more common is the formation of dykes and veins by the magma being forced along the planes of weakness in the rocks.

The solid material consists of large pieces of rock, cinders, ashes, and dust. Many cones are built up of layers composed of ash, cinders, and solid fragments of lava. When a volcano remains quiescent for any length of time, the crater becomes plugged by solidified magma—that is, lava—and by material falling from the sides, and when an eruption takes place, the presence of this plug may cause an explosion. Sometimes an eruption may cause a new vent to be formed on the side of the volcano and then a secondary cone is formed. The water vapour emitted affects the atmospheric conditions, and often heavy rains follow soon after an eruption. In the

eruption of Vesuvius in A. D. 79 heavy rains turned dust into mud, and it was a stream of volcanic mud which covered Herculaneum.

Some cones are made almost entirely of lava and the shape depends to a large extent on the viscosity of the magma thrown out. Some magmas cool quickly, flow slowly, and therefore solidify before they get far down the slopes of the volcano. Another kind of magma cools less quickly, flows easily, and sometimes travels for many miles before solidifying. Often these lava-flows devastate large areas, but in some of the most disastrous eruptions the damage has been caused in other ways.

The island of Krakatoa, in the Straits of Sunda, is the largest of a group of islands formed by the higher portions of the rim of a tremendous volcanic crater. In 1883 a number of explosions took place and a large part of the island was blown away. The islands were practically uninhabited, but great waves were produced in the sea, which drowned thousands along the coasts of Sumatra and Java. In 1902 a serious eruption took place on the island of Martinique in the West Indies. From a volcano called Mont Pelée a tremendous cloud of hot gases and dust was emitted. Owing to the dust, the cloud was heavy and rolled down the mountain-side, burning everything it touched. The town of St. Pierre, at the foot of the mountain, was quickly destroyed. It may appear strange that some volcanic lands are densely populated; that people live in towns and villages and farmsteads at the foot of volcanoes, and even on their slopes. The instance just mentioned is one example; others well known are provided by Mount Vesuvius in Italy and Mount Etna in Sicily. But some of the matter thrown out by volcanoes breaks up, in time, into very fertile soil, and men take the risk of eruptions for the sake of cultivating it.

Some volcanoes emit only steam and gases, and soon after this stage is reached, activity ceases altogether and the volcano becomes extinct.

*Hot Springs.*—In some volcanic areas hot water as well as steam is thrown out at intervals in the form of a fountain or comes from the ground as a spring. We find the best examples in the Rotorua district of New Zealand, in the Yellowstone Park of the United States, and in Iceland. Rotorua lies in the centre of the North Island and here is found almost every form of thermal activity. In the Whakarewarewa valley are many fountains or geysers—as they are

called—and the largest throw up water and steam to a height of 100 ft. In a neighbouring valley there are steam-jets, boiling pools, ponds of boiling mud, mud volcanoes, and sulphur beds. The Maoris use these pools and have boxed-in steam holes for cooking purposes. The waters are highly medicated, and both springs and warm mud baths are taken by people suffering from rheumatism and similar complaints.

*Geysers.*—A geyser is formed by water rising through a natural pipe into a hollow or basin. When the geyser is quiet the basin fills

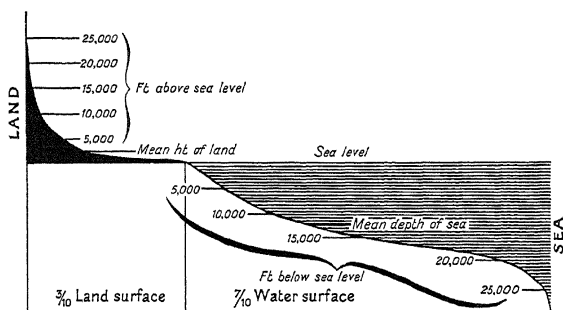


FIG. 152. THE HYPSOGRAPHIC CURVE.

with water, which presses down the water in the pipe. At the bottom of the pipe, the temperature gradually rises, but owing to pressure of water above, a very high temperature must be reached before the water boils. When this temperature is reached the water above is forced away, and immediately the pressure is reduced the water below is converted into steam, which throws the whole column into the air.

*Height and Depth.*—The distribution of land and sea—that is to say, the main features of relief (land areas and sea basins)—together with climatic and other conditions, have a close connexion with the distribution of life on the earth. But the minor details of relief have a strong influence too. Broadly speaking, we can say that the land-surface is made up of mountain systems, plateaus or tablelands, and plains, and before describing the modifications which take place on the surface, it is as well to form some estimate of the average height

of the land. To do this we refer to the hypsographic curve ; which not only gives areas of land at different heights but also shows the areas of ocean at different depths. Estimates have been made of the proportion of land at various heights and the proportion of the ocean at various depths. By means of these figures a graphic representation can be made. Areas are shown along the horizontal line and heights and depths by vertical distances. The highest point of the land is only about five miles above sea-level, so that on the diagram the heights are greatly exaggerated. From the diagram it will be seen that the mean height of the land is just under 2,500 ft. The areas under 2,500 ft. elevation (called the Continental Plateau) may be subdivided into depressed areas, lowlands, and uplands. The small area taken up by the land with an elevation between 2,500 ft. and 5,000 ft., we may call highlands. It will be seen how small is the area taken up by land which is higher than 5,000 ft. This may be regarded as 'mountainous' ; but it should be understood that these figures are merely a rough guide. We speak of the 'mountains' of the Scottish Highlands, three or four thousand feet high at the most : such elevations in the Himalayan mountain-system are those of mere foothills.

Sloping gently below sea-level, there appears in the diagram that shallow area which we have met with (in Part I) as the Continental Shelf. In many parts of the ocean it is very narrow or entirely absent, but in other parts—such as the North Atlantic—it has a width of several hundreds of miles (see, for example, Part I, pp. 5, 314).

*Mountains 'Young' and 'Old'.*—When setting out to study the work of the various agents of erosion (p. 442), it is well to keep in mind the distinction between those mountain systems which have been formed in comparatively recent times and those which were formed at some earlier period. The big mountain systems such as the Rockies, the Himalaya, and the Alps are the most recent. The eroding agents have been at work on these for a comparatively short time. Lofty peaks, sharp spurs, and ridges are still standing ; the rivers come down from the mountains by cascades and falls ; there are many lakes in river valleys ; and there is an accumulation of rock waste at the base of the mountains and in the valleys. The processes of erosion have not had time to wear away irregularities and produce smooth outlines.



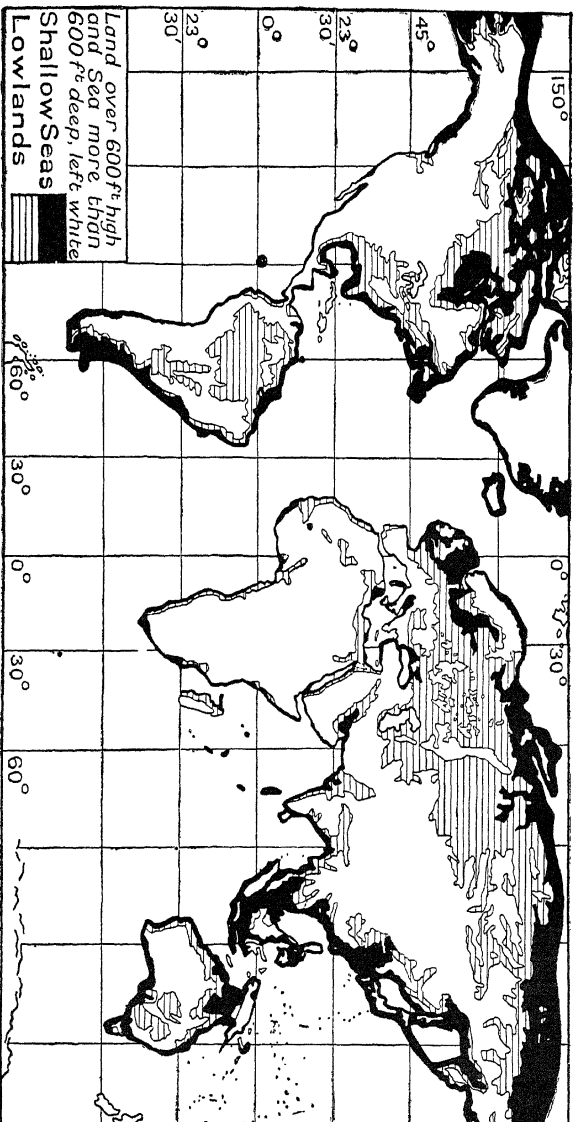


FIG. 153. THE CONTINENTAL SHELF AND GREAT LOWLANDS OF THE WORLD.

*Erosion and Accumulation.*—Now if we examine the form of some old mountain system, or the remnants of one, we shall find that it has few or no sharp outlines. It still forms uplands and may have an elevation of a few thousand feet. The central uplands of Europe are the remains of such a system. The eroding agents have worn this range down to mere stumps and cut away portions, so that now they appear as isolated blocks. The plateau of Spain, the plateau of France, the Ardennes, the Bohemian mountains and other uplands of this region once belonged to a big mountain system. Here we find that the rivers run in broader valleys, the beds of the rivers have been graded down and irregularities have disappeared. The

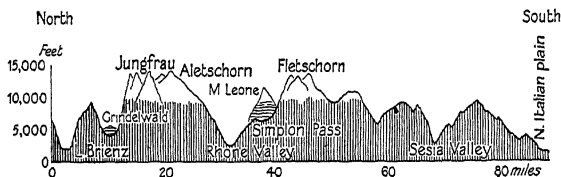


FIG. 154. SECTION THROUGH THE ALPS.

material worn away from the higher parts has filled up depressions and been spread over the lower areas. These lower areas are plains and lowlying river basins. They also are subjected to forces of erosion although the effects are less marked, and when a certain stage has been reached they become areas of accumulation. For example the Amazon, the largest river in the world, brings down, as we saw in Part I (p. 341), tremendous quantities of mud. The main channel is often crowded with floating islands. During the floods, small pieces of the bank break away, and these become held fast by the roots of plants which dangle from them. A large number of these portions of the bank become joined to form an island of perhaps an acre in extent. After a time the anchor gives way and the island floats down to the sea. But in the lowlands, away from the rivers, where there are huge forests, the roots of trees and shrubs bind the soil together and prevent erosion taking place.

*Frost and Chemical Action in Weathering.*—The weathering of rocks is often due to the action of frost and the chemical action of water. For instance, on mountain-heights subject to severe cold,

water, lodging in the crevices of rocks, alternately freezes and thaws; with freezing there is expansion, and so the cracks are enlarged. Small pieces of rock are broken off, and thus loose material accumulates on the slopes and in the valleys. The breaking off of angular fragments produces rugged surfaces and crags are formed.

Some beautiful examples of mountain shapes produced by the action of frost are found in the Lake District of England. In mountainous parts of the temperate lands, such as the Alps, the summits are very rugged and needle-shaped projections are formed. Below these, on the less steep slopes, protection is given by the snow which rests there and weathering is prevented to a great extent. On lower land where the temperature is generally above freezing point, we find that rocks decay owing to action of water which contains carbon dioxide and other substances in solution. More loose material is formed but the surface keeps a smooth outline, and the hills have a rounded shape.

In each case the amount of loose material varies greatly in different parts because some rocks are more resistant than others. In time even the most resistant rock will decay; for example granite becomes decomposed to form china clay (Part I, p. 45). Other chemical changes take place besides those due to the action of water. In moist air, oxygen will cause the rusting of iron; and many rocks contain iron, and show brown stains.

*The Work of Rain.*—Much of the broken material falls from the higher parts to lower levels by the action of gravity alone but the action of rain is more important. Smaller fragments are washed down the slopes and the larger fragments slide down gradually. On grass-covered and wooded slopes there is not so much loose material and roots bind the particles together so that the movement may be only small.

On steep slopes very heavy rainfall may cause a landslide: that is, a portion of a cliff may slide down and come to rest on a less steep slope below. When rain falls on the ground some of it soaks into the ground and some runs over the surface. That which sinks in is not lost, for it may form a spring which issues from the ground at a lower level and so forms a stream. The water which flows over the surface forms tiny channels, which eventually join to form rivulets, which are tributaries of mountain streams.

*The Work of Rivers.*—In wet regions rivers are important agents of erosion. In running over the surface of the land they carve out valleys. The loose material is washed into the rivers and so carried from the higher ground down to lower levels and finally to the sea. It is important to know exactly how this material is carried. Some of it is carried in solution, small particles are suspended in the water, and larger fragments are rolled along the bottom. It is obvious that the larger fragments move downstream more slowly than the other material, but this movement is sufficient to make them take a rounded shape and form pebbles. If these pebbles become worn by movement so also will the bed of the river become worn by the action of the pebbles passing over it. Any solid material carried by the river wears away the banks and bed. This wearing away process is called corrasion. Clear water effects very little corrasion; it is the material it carries along which enables a river to carve out a valley. If the river wears away its bed and its banks, then it adds to the load it is carrying, but there must be a limit to the amount of material a river can carry. If the river is quick-flowing and has a good volume of water it is able to carry a bigger load than a small, slow-flowing stream. The speed at which the water flows depends on the slope of the river; we know that mountain streams flow much faster than rivers flowing over more level country. There are many other differences between the river in the mountains or hills and the river in the plains. Because of these differences we can divide the course of many rivers into two parts: (a) the valley track, and (b) the plain track.

In the valley track the river flows quickly and is able to carry its load easily; this enables it to cut out and deepen its bed. This results in a narrow deep channel being cut out, and the sides of the valley are steep. The steepness of the banks depend on the rate at which weathering takes place, because the river wears away its banks but little. The material loosened by weathering is washed into the river by the action of rain; if the rainfall is small, the banks are steep, whether the rocks are resistant or not. There are only a few examples of rivers flowing through a dry region, but the Colorado (N. America) furnishes a wonderful example of a river having steep banks owing to the absence of rain and weathering. It is described more fully in Part I (p. 302). In the valley track the bed of a river

is uneven and often a series of steps is formed, over which the river flows in waterfalls.

When a river reaches lower ground, the slope of the bed becomes less and so the rate of flow is slower. This causes the river to deposit some of its mud, and when this stage is reached, the river can no longer deepen its bed; though it can still wear away the banks. A river follows the lowest line of its valley. When a bend is formed, the river tends to increase the curve of the bend, and we find that most rivers of the plain have winding courses. In any part of a river where a bend occurs, the current is forced against the incurve of the bank, which is cut away, while on the opposite bank the current is slower and sand, gravel, or mud is deposited (see Part I, fig. 95). In this way the bend moves downstream and becomes more accentuated. The river tends to double back on itself and the bends become horse-shoe in shape. They are called meanders. Many British rivers have well-developed meanders, but the river Meander in Asia Minor (Part I, p. 211) may be called the original example, for the term is taken from its name.

As meanders are formed the bed of the river changes its position. In swinging from side to side the river lays down a flat or plain, only covered with water, if at all, during floods, and hence is called the flood-plain.

Most rivers are liable to flood—some more so than others—and generally this is due to large supplies of water provided by heavy rainfall or from the melting of snow. When large quantities of water are available, the upper streams become swollen torrents which bring down large quantities of debris. This debris is deposited on the sides or banks of the river and the flat river plain.

When floods subside the mud remains, and the banks are now higher than before. During subsequent floods the mud deposited raises the banks higher and higher and eventually the river channel may lie above the level of the flood-plain. Rivers with raised banks are common in lowlying country such as the Fen district. The Mississippi in North America, the Hwang-Ho in China, and the Po in Lombardy are examples of this type of river. In flood-time they are liable to overflow and even burst through their banks. (On the Mississippi cf. Part I, p. 299).

In the valley track a river deepens its bed, as we have seen, and

the slope becomes steeper, but in the plain track deposition causes the slope to become flatter. As a river approaches its mouth the current becomes slower and finally ceases. When this happens, a delta is formed. But where there are strong tides or currents along the coast any material brought down by rivers is swept along and distributed over the continental shelf. If erosion in the valley track and deposition in the plain track go on for a sufficiently long time, a stage will be reached when the river flows down a gentle slope. The bed of the river is planed down, projecting portions being worn away, hollows and depressions filled. If the projecting portions of the bed are formed of hard rocks, they will resist erosion, but, as will be explained presently, in time they, too, will disappear. The gentle slope, down which the river eventually flows, takes the form of a curve, which is sometimes named the 'curve of erosion'. Above the source of the river, the ridge or hill (the watershed) on which the river starts to flow is not eroded by the river itself, but rain and weathering (described on p. 449) gradually lower it.

Let us imagine the result of this in the case of a whole river-system or a number of river-systems, which may make up the drainage of a region. Every river—even the tiniest stream—will take its part in the work of erosion, by deepening and widening its valley; the areas of higher ground between rivers (tributary watersheds) are denuded by the action of rain, frost and other agencies. Thus, the ultimate result of all this erosion is to lower the level of the whole region; and the general level becomes so nearly a plain that the name given to any tract of land, which has been cut down in this way, is a 'peneplain'. Examples of peneplains are to be found in many parts of the world: such, on a large scale, are the Laurentian region of North America and the region of North-western Europe lying around the Gulf of Bothnia; and in both cases glacial action has assisted in the work of erosion. The portion of the Guiana region of South America lying to the east of the Essequibo, and the Otago peneplain, forming the southern portion of the South Island of New Zealand, are other examples.

*The Work of Wind.*—In arid or desert regions the most important agent of erosion is the wind. In such regions there are vast stretches of sand heaped up by the wind into dunes and hills some hundreds of feet high. In the hot dry regions the range of temperature is great

(p. 468), from very warm days to cold nights. These rapid changes cause the rocks to crack by expansion and contraction, and the fragments of rock are broken still further by the action of dew. In much the same way that a river wears away its bed by means of the pebbles it carries along, so the wind, by the dust particles it carries, erodes or etches any surface over which it passes. Larger fragments cannot be carried, but they are rolled along the ground, and therefore the greatest corrasion is near the ground. A dune or sand-hill is formed by the wind heaping sand over some obstacle which lies in its path.

*Glaciers and their Work.*—In temperate regions, where frost-action causes weathering, the temperature is sometimes above and sometimes below freezing-point; but in very cold regions it is always below this point except during the very short summer. On the tops of high mountains, which are snow-capped throughout the year, the conditions are similar. Just below the snow-line, the results of frost-action are best seen, for there we find very sharp peaks and ridges. In regions above the snow-line, where the fall is sufficiently heavy, the snow accumulates to a great depth, especially in valleys and on plateaus, and snowfields are formed.

The lower layers of snow are consolidated into a kind of ice by the weight of the layers above. More snow falls on the top of this mass and the extra weight causes it to move downwards. Where there are steep slopes the snow often falls in large masses by its own weight. Such falls are called avalanches. Where the slopes are less steep a mass of snow and ice moves slowly and forms a glacier. In some ways a glacier resembles a very slow-flowing river and sometimes is spoken of as a 'river of ice'. From the snowfield a glacier moves down a valley between ridges of high ground and often smaller glaciers join it from tributary valleys. Where a snowfield is very large, two or more main glaciers may spring from it.

The rates of flow of different glaciers vary greatly. In the Alps they move slowly, the rate of flow being only one or two feet in a day, but in mountains of the Arctic regions sometimes they travel much faster.

As a rule, the surface of a glacier is not smooth, but broken up by transverse cracks of varying width; these are called 'crevasses'. They are caused by tension which is due to the unevenness of the

valley floor. As in the case of a river, the centre of the glacier flows more quickly than the sides and this tends to make the crevasses take a curved shape. A glacier scratches, rubs, and breaks up the rock-surface over which it flows ; and it may even dig out deep valleys. The material which it collects is carried along on the top of the glacier and also in its base, and is deposited at the end of the glacier. The end of the glacier is determined by the melting of the ice, and here this waste material forms a mound or ridge called the terminal moraine.

The Alpine glaciers are very small compared with the great masses of ice found in the Polar regions. Some very large ones are found in Alaska, Greenland, Spitsbergen, and the Antarctic. In Greenland and the Antarctic the glaciers often take the form of tremendous ice-sheets which cover thousands of square miles. When a glacier reaches the sea the end is buoyed up and broken off by the action of waves ; or the glacier may end at a cliff so that masses of ice break off and fall into the sea. Such broken masses form icebergs.

The glaciers found in the higher mountains of Europe are now comparatively small but formerly they were much more extensive. During the Ice' Age the whole of northern and north-western Europe was covered by an ice-sheet<sup>1</sup>. Valleys, which have been glaciated at some previous time, show certain peculiar features which are not to be found in valleys farther south, away from the ice-front. By examining these features we are able to learn more of the work done by a glacier than we can by examination of a valley filled by ice at the present time.

When a valley has been occupied in the past by a glacier, we find that irregularities have been smoothed out, and the valley has been straightened. The surfaces of projecting rocks have been rounded but they are marked by parallel scratches and grooves. Such rocks are called in French *roches moutonnées* ('sheep-backed rocks'). The scratches were made by stones and boulders frozen in the base of the glacier.

When a main valley has been deepened by a former glacier but now has a river in it, very often the floor is at a lower level than that of

<sup>1</sup> Some examples of the signs of glacial action in Britain are given in Part I, p. 10. For the extension of the ancient ice-sheets over Europe see Fig. 42, and for North America Fig. 90, with accompanying text.



some tributary valley, so that the water from the tributary enters the main stream by a waterfall. These 'hanging valleys', as they are called, are common in glaciated regions.

*Watersheds and River-capture ; Passes and Valleys.*—A mountain system may consist of a ridge or series of ridges with valleys between, of dome-shaped masses and of plateaus. For a simple example the Pennine Chain in England may be taken. This forms

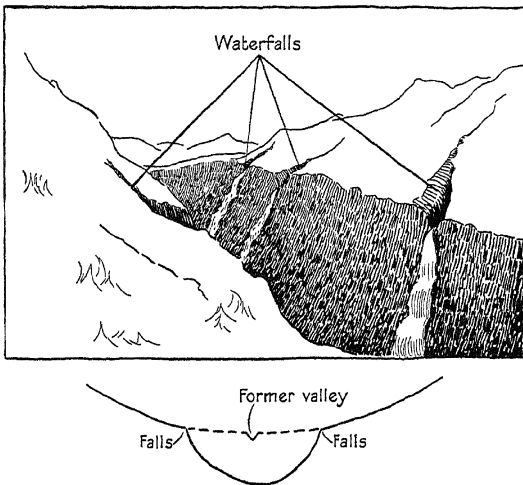
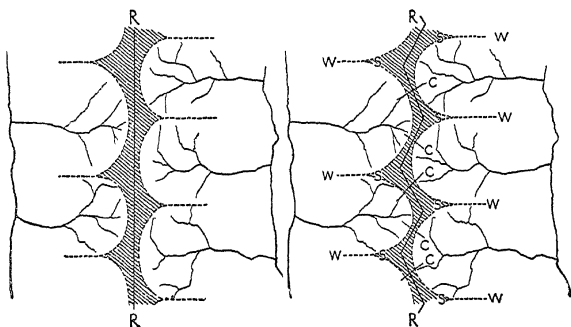


FIG. 155. SKETCH AND SECTION OF A GLACIATED VALLEY.

a watershed or parting from which rivers run down to the east and west coasts. On the eastern side the rivers are the longer and more important. A river is made up of a number of streams and, owing to inequalities in slopes and differences in the resistance of rocks, the streams do not erode at the same rate. We find that some valleys are carved out more quickly than others. The more energetic streams capture the waters of other streams and lengthen their valleys. In this way large systems are formed and replace smaller systems. The Yorkshire Ouse is an example of a large system which has been formed in this manner.

In Figs. 156, 157 the lines RR represents the water parting, and

ivers are shown flowing down the opposite slopes. Not only do these rivers deepen their valleys but they are able to cut back at their sources. In this way the ridge is cut into at the head of each stream and takes a zig-zag form. Between each valley a spur runs out from the ridge. If one of the streams cuts back more rapidly than others it will receive their waters. In time it may cut back through the ridge and form a gap. The rivers Tyne and Aire have cut deep gaps in the Pennines along the lines of faults. Such



FIGS. 156, 157. The left-hand diagram represents a watershed formed by a ridge RR. The dotted lines define the areas drained by a series of rivers. The right-hand diagram shows a later stage, at which the rivers have cut back into the ridge. At the points c there may be low cols or passes. The lines w indicate secondary ridges and watersheds.

gaps are extremely important for they provide natural routes through mountainous districts. Many river valleys in the Alps are important for this reason, in that they give routes for roads and railways and lead up to the passes. By the formation of these river systems mountain regions are divided into sections. The processes of erosion have not reached maturity in the case of the Alps; yet we find definite groups such as the Graian Alps, the Pennine Alps, and many others.

In the large mountain systems we find many ridges, and generally the river systems are more complicated than those in the Pennines. Sometimes a river runs along the valley lying between two ridges. Such river valleys are called longitudinal because they lie parallel to the general direction of the mountain system. An excellent

example of such a valley is given by the river Indus. If the course of this river be traced out, certain peculiarities are noticed. It rises on the edge of the plateau of Tibet and runs along the northern edge of the Himalayas in a north-westerly direction to about long.  $75^{\circ}$  E., when it turns through a right angle almost to the south for a short distance before it turns back to the north-west. The river continues in this direction for a comparatively short distance and then turns through another right angle to take its course in the direction of the Punjab. The two turns which the river takes enable it to cut across the Himalayas. Valleys so cut across a range are termed transverse valleys. It is not easy to understand how a river could cut backwards through high ridges of this kind. It is possible that

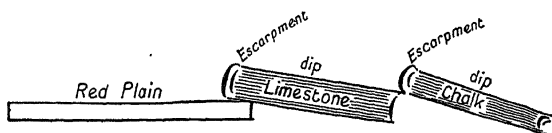


FIG. 158. A rough representation, by means of a board and books, of the relation between the red sandstone plateau of the midlands, the limestone, and the chalk, in England. (Cf. Part I, Fig. 6.)

the river flowed there before or during the time that the Himalayas were being elevated. If the crustal disturbance was slow, the river would be able to erode as fast as the range was uplifted. Imagine a piece of soap pressed up against a taut wire; then the wire will cut into the soap in somewhat the same way that the river would cut into the ridge.

If a contour map of some mountainous region be studied it is easy to see how the mountain masses are split up into sections by the river systems. As we have already explained, this is not due entirely to river action but also to glaciation, and on the margins of the big mountain systems very big moraines are found in the form of ridges and mounds.

The result of the combined action of river and ice may be well seen in Alpine valleys. The figure shows the profile or section of such a valley. A good example of erosion by glaciers is seen in the case of Snowdon. Large hollows have been scooped out from the sides of the mountain. In Wales such a valley is termed a *cwm* (coom), in the Alps it is called a *cirque* (circuit), and in Scotland

a corrie. Between glacial and river valleys ridges are formed and, as was explained by the ideal river system, these ridges often culminate in peaks which are separated by cols or passes.

The distribution of hard and soft rocks determines to a large extent the direction of flow of the rivers, therefore we find usually that the ridges and spurs are formed of the more resistant rocks. Across the plain of south-eastern England we find that ridges and hills are formed of limestone and chalk. The river systems have cut away this material in many places and so ridges are left. The river beds

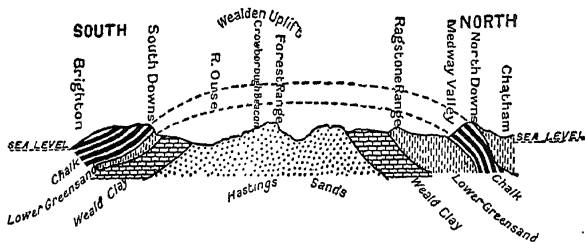


FIG. 159. A SECTION THROUGH THE DOWNS AND THE WEALD.

are formed of soft strata which dip under the harder rocks, and where the rivers come against these, escarpments are formed. The figure represents a section from the Severn to the Thames.

The Weald of Kent once had the form of a chalk-dome. The crest has been planed away and rivers have made gaps through the rims. On the north and south sides chalk scarplands stand up to form the highest points in the district.

When the watershed is formed by a dome-shaped mass, such as the Lake District of England, the rivers ran down the sides from the centre, and, allowing for the changes made by erosion, they may still be seen to radiate from the centre.

*Waterfalls.*—In a region which has been recently folded or fractured, there are many steep cliffs and slopes so that rapids and waterfalls are common. But there are other ways in which rapids and falls are made. In describing the work of erosion performed by a river, we assumed that the bed was uniformly resistant, but this is seldom the case. A river will try to cut its valley in the softest parts, but the rock-beds may lie in such a way that an outcrop of

hard rock crosses the river bed. On the downstream side of this outcrop the soft bed is cut away easily, and thus a step is formed. A fall formed in this way is to be seen in the river Tees at High Force in Yorkshire, and such falls are not uncommon in other rivers of the Pennine area and in the Lake District. Examples on a much larger scale are the cataracts of the Nile (Part I, p. 252). If the rock-beds lie in a horizontal position, with a hard bed on the top and a softer bed underneath, the soft rock may be undercut by the action of the falling water. This undercutting causes portions of the hard-

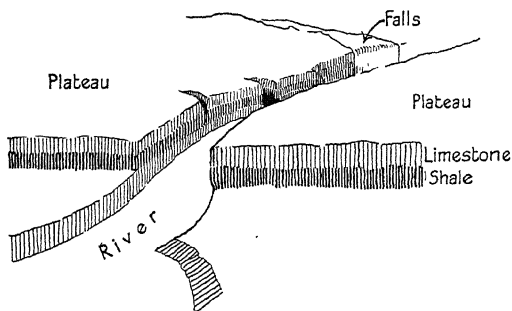


FIG. 160. A SKETCH DIAGRAM OF NIAGARA GORGE AND FALLS (cf. Part I, Fig. 91). This sketch suggests the way in which the gorge has been formed as the river cut back the ledge, and the falls receded, from the edge of the plateau.

jointed rock to fall ; and so the waterfall gradually moves upstream. In the case of the Niagara Falls the hard bed is formed of limestone and the soft bed of shale. Originally the waterfall was situated where the river flowed over the edge of a plateau, but undercutting caused slipping of portions of the overhanging limestone and so the falls gradually receded. The falls are now at the head of a gorge seven miles from the edge or escarpment of the plateau. In the case of the Victoria Falls on the Zambezi, the river plunges from a high tableland into a deep gorge several miles in length. It is most probable that these falls have been formed in a way similar to those of Niagara (Part I, figs. 79, 91).

As Africa consists mainly of a huge plateau or tableland, nearly all the rivers have rapids or falls in their courses. To reach the narrow coastal plain they have to descend some hundreds of feet from

this plateau. The Nile, the Congo, and the Niger all form waterfalls of considerable size. Given time, it is not difficult to see, from the example of Niagara, how a river can cut down the level of the land and so help to form a peneplain.

*Inland Drainage Areas.*—In some parts of the world which are desert or nearly so, but receive drainage from land sufficiently high to get some snowfall or rainfall during part of the year, there are rivers which may or may not reach the sea. Of such rivers which do reach the sea, the Nile is the most remarkable example (Part I, p. 251). Other such rivers, on reaching lower ground, quickly dry up

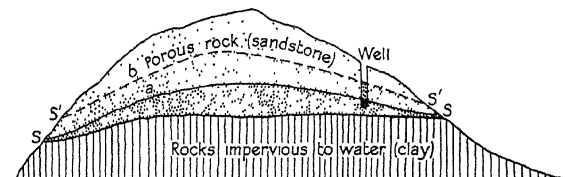


FIG. 161. Section showing how water accumulates above an impervious stratum. The curves *a* and *b* represent different levels of saturation: the level of water in the well depends on the position of this level. Curve *a* may be taken as the mean level of saturation, and permanent springs are found, as at *s, s*, where the water-level reaches the surface on slopes. Curve *b* may be taken as a wet-season level, and *s's'* as representing intermittent springs.

or form salt marshes. When rivers are unable to reach the sea, but drain into an inland basin, they are said to form an inland drainage area: of these we have found examples in the Caspian basin, Central Asia and Iran, and in Australia.

*Underground Waters.*—From the descriptions of land-forms already given, it will be apparent that the more resistant rocks tend to stand up as hills while the softer parts of the land are worn down to form valleys or plains. The ridges which traverse the south-eastern part of England are mostly formed of chalk and limestone (Part I, pp. 22–3), which resist ordinary weathering to a great extent. But limestone is soluble in water, especially carbonated water, and in temperate regions we find certain peculiar features in limestone regions. We have found (p. 431) that in some rocks, planes of weakness are developed and joints are formed, and this is especially the case in many limestones. Solution takes place along these joint-planes more than elsewhere, so that the drainage passes under-

ground. When rain falls on the earth, the amount of water which soaks into the ground depends to a great extent on the porosity of rocks. If the surface is formed of chalk (soft limestone), water penetrates easily, and sinks down until it comes to a bed of impervious rock such as clay, where it collects. The porous rock becomes saturated just above the impervious layer. If the rainfall is sufficiently heavy, the water accumulates and springs are formed, or the water can be collected in wells and drawn up for man's use. During a period of drought the level of saturation (called the water-table) will fall very low, and if a well be not bored sufficiently deep

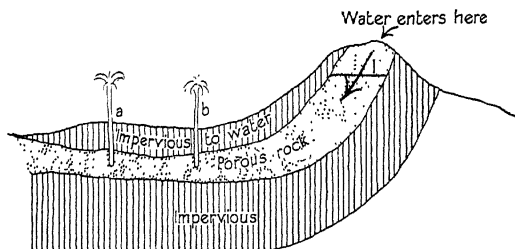


FIG. 162. Section to illustrate artesian wells (*a*, *b*). Water gushes out when borings are made, because of the pressure under which it is kept in the porous stratum.

it may become dry at such a time. If the rock-beds are formed in a down-fold, such as shown by the figure, the water accumulates more easily, and should a permeable bed lie between two impermeable beds we have the conditions for the formation of an artesian well. Such wells are named from the old French province of Artois, where they were early used ; but they have become more important in the development of drier lands, and the leading example is found in Australia (Part I, p. 374). The rain falling on the outcrops sinks down and the porous or permeable bed becomes saturated. Where the water rises to the level of the junction of the beds, springs are formed. If wells are bored the water is forced up by hydrostatic pressure, that is, the pressure caused by the weight of the water standing at a higher level.

Even in the driest regions of the earth water collects below the surface of the ground, although it may be at a great depth. In

deserts, oases mark the spots where such water is relatively near the surface. Oasis, a word meaning a fertile spot in desert, is taken from Greek, but probably its origin is Egyptian.

Limestone beds are frequently thick, and when they lie in a horizontal position, or nearly so, the joint-planes are vertical. Rain-water finds its way into these joints and enlarges them by solution, so that caves are formed and an irregular underground passage for water is made through the cracks and joints of the rock. Owing to this underground drainage, limestones have few surface streams and therefore little surface erosion takes place. Erosion along the joints cuts the surface up into more or less quadrangular blocks. There is little or no soil formed and therefore vegetation is very scant, usually taking the form of short herbage, such as is found on the chalk downs. In parts of the limestone region in Yorkshire almost bare surfaces (called clints) are found. An excellent example of a limestone mountain region is given by the Dolomite Mountains (eastern Alps). The jointing is so regular and well developed that extraordinary, and very beautiful, mountain-forms are produced. The regularity in the form of precipices and pinnacles is remarkable. Along the tracks of the underground streams caves are generally formed in plateaus of limestone. If near the surface, such caves occasionally fall in and depressions are formed on the surface. As a cave is part of an underground watercourse, water which collects in such a surface depression will quickly drain away, and the depression is called a sink or swallow-hole. These holes may be formed by the enlarging of joints as a result of solution, but they are not formed or enlarged to any great extent by erosion of stones and sediment carried by falling streams. If a swallow-hole reaches down to a level where the jointing is badly developed, the water will run along this particular plane, and should this plane reach the surface in a valley, the place will be marked by the reappearance of an underground stream. Above the plane, much solution may take place and large caverns may be formed, and are often enlarged by falls of rock from the roof. An excellent example of a swallow-hole is Gaping Ghyll on the side of Ingleborough, in the Pennine Chain. This hole is 365 ft. deep, and at the bottom it opens into a cave 480 ft. long, 80 ft. broad, and 110 ft. high.

The best-known limestone caves in Britain are found in the Mendip Hills in Somerset, in the Peak district of Derbyshire, and near Settle



in Yorkshire. The water which trickles through into the caves contains carbonate of lime as a result of solution of the limestone, and some of this lime is deposited either on the floor, or the roof. In this way the floor, ceiling, and walls of the cave become encrusted with curiously shaped masses of carbonate of lime. The cone-shaped lumps on the floor are called stalagmites and the icicle-shaped structures which hang from the ceiling are called stalactites. In very early times some of these caves served as dwelling-places for man and for animals, and in many cases remains have been preserved in the deposits of stalagmite or in the clay left after the solution of the limestone and collected on parts of the cave-floor. From discoveries made in such places much has been learned concerning the life of early man.

*Coasts.*—The sea beats on the margins of the land and often succeeds in wearing away large portions ; but erosion does not take place on every coast. In many places the land is gradually gaining on the sea. A very clear example is found in the way in which the land is built out by means of rivers forming deltas. The flood-plain of the river is gradually built out into the sea in a manner not unlike that of constructing a railway embankment. The mud brought down by the river is deposited at its mouth, and where tides and sea currents are not sufficiently strong it is not carried away. Thus the mouth of the river is partially blocked and mud flats are formed. A river deposits mud at its mouth because when the river-current enters the sea it slackens and is unable to carry all its load.

*Deltas.*—Where these mud-flats are formed the river may be unable to cross them as one stream, but does so by means of several channels (distributaries), each of which builds up its own tongue of mud. In this way the delta becomes fan-shaped or triangular ( $\Delta$ , the Greek capital letter 'delta'). Triangular deltas are usually found in almost tideless seas, and if a tide is present very large quantities of mud must be brought down in order to form a delta. This latter type is almost certain to be irregular in shape, as for example the Rhine delta. The Mediterranean sea is almost tideless, and consequently most of the rivers have deltas. The Nile has a large delta of the true  $\Delta$  shape, and the river Po has added considerably to its flood-plain, for the town of Adria, originally on the coast, is now inland. A feature of the Nile delta—also seen in other rivers—is the formation of a number of lagoons or lakes. This is due

to the action of a current flowing from west, which deflects the tongues of mud to one side, and portions of the sea are enclosed by them.

When a strong tide runs well into it the mouth of the river is kept comparatively free from deposits (there is always some amount of mud on the bed of a river) and it forms an estuary (i.e. the tidal portion of a river). Most of the larger rivers of the British Isles have estuaries; none has a delta. When the tide is rising the sea runs

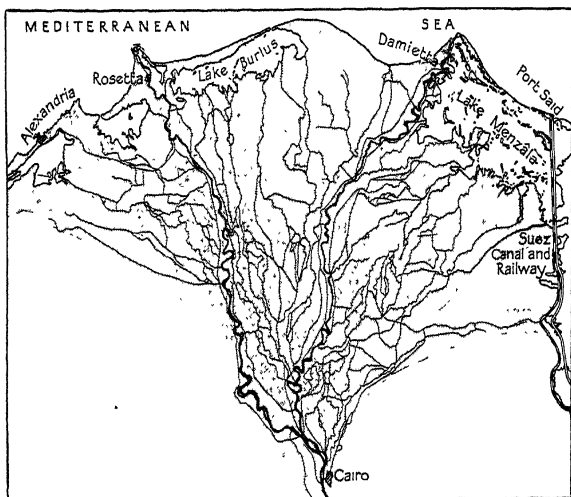


FIG. 163. THE ALLUVIAL DELTA OF THE NILE (shaded). If turned upside down, the  $\Delta$  form is seen.

up the estuary and holds up the river current, and this is not released until the tide falls. Then the river water flows out strongly and flushes out the mouth of the river. The estuary of the Thames is not entirely free from sediment and some dredging is necessary, but this is small compared with the amount needed in some rivers to make navigation possible for big ships. The Ganges brings down great quantities of mud, much of which remains and thus necessitates constant dredging, and the watching and charting of the channels.

*Coast Erosion and Deposition.*—Along some coasts the sea currents are responsible for the building up of the land, but the material

used is brought from another part of the coast. To the east of the Wash the land has been added to by the heaping up of shingle and sand. Sometimes a sand-bank or bar is formed, such as Chesil Bank (Part I, p. 24), or it may take the form of a beak like Spurn

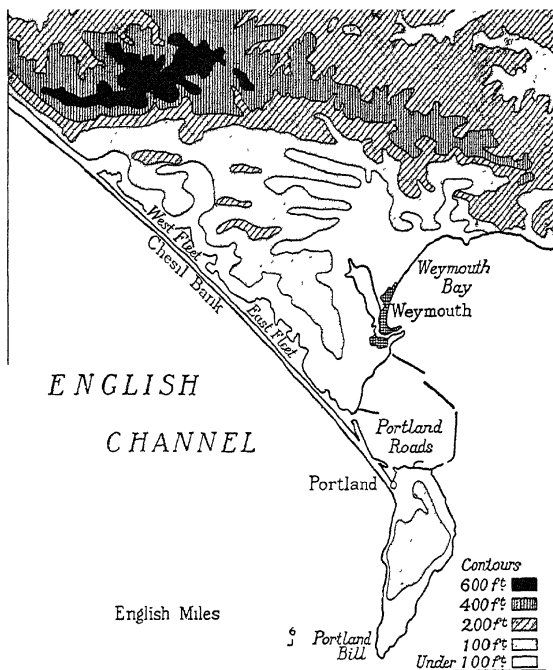


FIG. 164. CHESIL BANK.

Head at the mouth of the Humber. Along the coast of Holland and Germany we have found many sand-banks and sand-bars, and in many cases the bars have been built across bays and so converted them into lagoons (pp. 112, 115).

Where coasts face the open ocean, very often the sea cuts back the land to form cliffs. Where the sea cuts into a cliff it forms a marine platform. In Scotland and in Norway a series of these are

found, one above another, forming terraces. In past geological times these land areas have been elevated, and between successive elevations the sea has had sufficient time to cut out platforms. Naturally, the sea wears away more easily land composed of soft material, but another important factor is the strength of the waves. In the open ocean they are stronger than in a partly enclosed sea ; and to some extent this explains why the south coast of Britain is smooth and the exposed parts of the west coast are rugged. Waves have no great power to erode by themselves, but they do so by

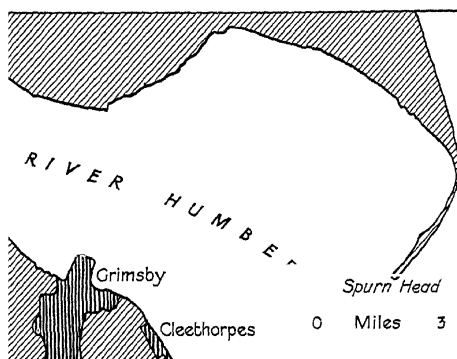


FIG. 165. SPURN HEAD.

throwing up pebbles and sand against the cliffs. When once a crevice or hole has been formed in the face of a cliff it is soon enlarged. The air in the hole is compressed by the waves coming up against the entrance to it, and this repeated compression and expansion of the air loosens material, which is easily removed.

*Rising and Sinking Coasts.*—Although the action of the sea has a great influence on the shapes of many coastlines, the movements of elevation and depression of the earth's crust have a greater. When a part of the continental shelf is lifted above sea-level, a coastal plain is formed. The coastal plain which stretches from New York southwards and is bounded by the Appalachians on the west, is of this type. The same example will serve to show what happens when a portion of the land sinks. The movement of elevation should give

a smooth outline, but the east coast of the United States is very irregular. As soon as the coastal plain was formed, rivers started to carve out valleys across it, and later, when a sinking of the coast took place, the sea entered the valleys of the rivers (Part I, fig. 94).

The shape of any coast formed by the sea flooding the land depends on the character of this land. If the land is lowlying the coastline is winding, with open bays, because the sea enters every slight depression.

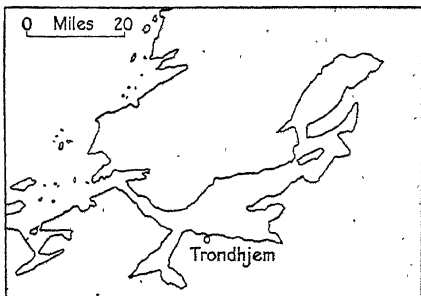


FIG. 166. A NORWEGIAN FIORD and section along its bottom.

*Fiords and Rias.*—If the land is high and the valleys narrow, a deeply indented coast is formed. If the rocks are hard, the sea takes a long time to wear away the land and there is little or no beach. Examples of this type are found along the coasts of Norway, western Scotland, British Columbia, southern Chile, and the south-west of New Zealand—all westward-facing coasts. Excepting the last, they are fringed with many islands, which represent the highest parts of former land-surfaces, now surrounded by water. The deep inlets are known generally, from the Norwegian word, as fiords. These inlets are narrow and penetrate far into the land. In some cases the rock-walls of the fiord are almost perpendicular. A curious feature of a fiord is the shallowness of the entrance from the sea. It will be seen in the figure, showing an ideal section of a fiord, that a basin

has been scooped out, probably as a result, at least in part, of former glacial action.

The sinking of a region of ridges and valleys, where these cut the coast transversely, results in the formation of long rocky promontories separated by long narrow inlets called rias. The promontories taper seaward and the inlets become narrow and shallow as they run inland. Examples are found in the south-west of Ireland and the north-west coast of France. Erosion has separated parts of the promontories and formed them into islands. This type should not be confused with the fiord-coast. The continent of Africa and the Deccan peninsula of India are examples of plateau-lands with smooth coastlines. In most places the plateau is fringed by a narrow coastal plain, which has been built up by deposits brought down by the rivers.

*Coasts and Communications.*—It is necessary in our world-study to watch the effects of these various coast-formations upon man's activities, and especially upon communications. In viewing any country which has a coast, we look to find whether that coast is easy for ships to approach, and has good harbours where they can lie. These harbours may be in the estuaries of rivers, or they may be in sheltered bays and inlets ; more rarely, they may be entirely artificial harbours, built by men where there are no estuaries or inlets. This suggests that harbours, to be useful, must be easy to approach, not only by ships from the sea, but also by railways and roads from the interior of the land. It is then seen why an estuary, though it may need constant dredging to keep it fit for shipping, may be far more important as a harbour than (for example) a fiord where ships can enter and lie without any difficulty. The estuary gives easy access to a river-valley, and the valley to the interior of the land ; the fiord does not. Contrast, again, the great deltas : through some of these one of the river channels is kept navigable for big ships, so that the principal ports lie up the rivers—the Ganges, the Mississippi, and the Danube give examples. In other cases this is not so, and the principal ports for the river-valleys stand on the coast, aside from the delta : the Nile and the Indus give examples. Both of these are rivers which flow through dry lands, and the amount of water which they pour into the sea varies, and at some seasons may be very small. Thus, as throughout our geography, different physical conditions may affect the work of man in the development of his activities.

## XV. THE AIR

### WEATHER AND CLIMATE<sup>1</sup>

*The Terms 'Weather' and 'Climate'.*—By 'weather' is meant the conditions of the atmosphere at any place at a particular time. In many parts of the world these conditions are regularly observed every day, and the observations recorded. When records have been made continuously for a number of years, it is possible to strike averages and to find that certain conditions of temperature, pressure of the atmosphere, amount of rainfall, and so on, are characteristic of different parts of the world. These average conditions at any place make up its climate.

*Weather, Climate, and Man.*—Climate profoundly affects the life of man. Throughout the study of geography we have to watch how in different lands different sorts of climate are accompanied by different types of vegetation, and by different types of animal life, whether wild or domesticated. In some parts of the earth it is found that rain does not fall at all seasons, and it may be necessary for man to construct great irrigation works in order to save water for cultivation during the dry season. Or, again, it may be of great importance to know at what season rain falls, especially when there is not much of it, for the season of rainfall may be right for the growing of crops, such as wheat, or it may be wrong. Climate may even affect the temperament of man, and an extreme climate, like that of the cold Arctic regions or the hot equatorial lands, may be so difficult for human life that men who live in these conditions never can rise high in the scale of civilization. On the other hand, a temperate climate which does not as a rule affect men's bodies with severe extremes of heat or cold, leaves them free to develop the arts of civilization, and even fits them to adapt themselves to a certain extent to less favourable climates in other parts of the world.

*The Atmosphere : General Conditions.*—The atmosphere is held to the earth by gravity ; that is, by its own weight. It is a fluid, and it presses, as fluids do, equally in all directions. Therefore we do

not feel the pressure, which at sea-level equals, on average,  $14\frac{3}{4}$  lb. per sq. inch. In considering the three 'spheres' (p. 427) we found that the atmosphere is 80 to 100 miles thick, or more. At great heights its conditions are quite different from that of the air which we breathe, and the whole of the changes in the atmosphere which make up what we call weather—heat and cold; wetness and dryness; clearness and cloudiness, and so on—take place within the lowest layer of the atmosphere, not more than 6 to 10 miles thick. Within that lowest layer not only the pressure but the temperature decreases, as a rule, from the bottom to the top.

The atmosphere has been compared to a great steam-engine. The engine draws its heat from the sun. The sun pours forth radiant energy through space. This energy is converted into heat when it meets any matter or body which absorbs it. Thus, although the sun's energy is not actually heat as it passes on its way from sun to earth, we can say justly that the earth derives heat from the sun. By this heat water is evaporated into the air, as vapour, from the sea and other waters on the earth, from snowfields and glaciers, and from moist land surfaces. The atmosphere always contains more or less water vapour which we cannot see, but which is a part of the atmosphere of greatest importance in the study of weather and climate. By cooling as it rises from the lowest layer of the atmosphere, some of the water vapour is condensed into clouds or rain, which we can see. By this condensation water is returned to the land to flow in rivers, and, directly or through them, to the sea, shaping, on its way, the surface features of the land as we have found already. During this process of evaporation and condensation there is set up the whole controlling influence of the weather all over the world.

We are concerned chiefly with the features of climate which we can see or feel. We are affected not only by heat or cold but by the dryness or dampness of the air. For this dampness the term 'humidity' is generally used. Humidity may vary greatly from day to day or between day-time and night-time. But in comparison with such daily changes it does not vary greatly, in most parts of the world, as between one season and another. We feel the moist hot day to be more oppressive than the dry hot day, and the moist cold day much more unpleasant than the dry cold day. The variation of heat and humidity in the British Isles is not harmful; but in some



equatorial lands, for example, it is so to people not accustomed to it, and even if not harmful it is hard to bear and makes work difficult or impossible. On the contrary, people who emigrate, let us say, from the British Isles to the interior of Canada, find hotter summers and colder winters than they have known at home, but the greater heat and cold often do not seem so severe as they might because humidity is lower.

We ought also to consider the pressure of the atmosphere, which we can neither see nor feel, because it is so closely connected with the other phenomena.

*Measurement of Pressure: the Barometer.*—The atmosphere, as we have found, presses equally in all directions. This pressure is measured by an instrument called the barometer, the name meaning 'the weight-measurer'. In the best kind of barometers a column of mercury in a tube is used to do the measuring. A column of this very heavy fluid just under 30 in. in length balances the average pressure of the atmosphere when at rest at sea-level, and the column rises or falls in the tube according as the pressure changes; thus we can express the pressure in inches and tenths of inches. Twenty-eight inches is a very low pressure and 31 in. very high, so that the range of pressure in inches is small. There is therefore a finer measure called a millibar, or thousandth part of a bar. The bar is taken to equal the pressure of a column of mercury 29.53 in. high, with air-temperature at freezing-point, in 45° latitude. The pressure of 28 in. = 948.2 millibars, 29 in. = 982, 30 in. = 1015.9, and 31 in. = 1049.8.

*Measurement of Temperature: the Thermometer.*—Temperature is measured in degrees, on various scales, of which that which we commonly use is the Fahrenheit scale, shortened as 'Fahr.' or 'F.' It was devised by Gabriel Fahrenheit, who took as 0° the lowest temperature obtained with a freezing mixture of ice and salt, and the boiling-point of water at average atmospheric pressure as 212°; while the freezing-point of fresh water, on this scale, is 32°.

*Measurement of Precipitation: the Rain-gauge.*—Rainfall is measured in inches and tenths by catching some of it in a bottle or jar through a funnel and measuring it in a glass graduated to show what depth of fall it indicates over the surface of the land where the gauge is situated, supposing that none of the water were lost by

running off or soaking in. Snow has to be melted and measured as water. The total amount which is precipitated or falls from the atmosphere at any place, whether rain or snow or hail, is spoken of as the precipitation of that place.

There are other more exact measurements for pressure, temperature, and rainfall, which we do not need here.

*Means, Maps, and Iso Lines.*—When a great number of observations of pressure, temperature, and rainfall have been collected, and the mean or average drawn from them for many places, the results can only be clearly understood when plotted on maps, if we are to understand what the averages show in relation to the whole of a country

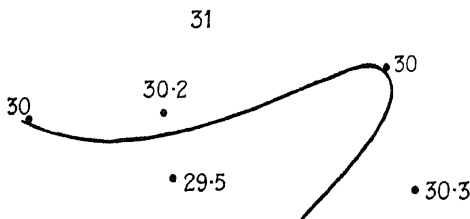


FIG. 167. THE MAPPING OF MEAN ANNUAL RAINFALL.

or to the world. The method resembles that of laying down contour lines. Let us suppose we are to make a map showing the distribution of rainfall. The figures for the rainfall in inches, and tenths, or in millimetres, for each place of observation, are written on the map against the position of that place. Then, on consideration of the positions of these figures, a line is drawn through all points which have, or may be supposed to have, a certain amount of rainfall. Thus if Fig. 167 were part of a map on which observations of mean annual rainfall were plotted as shown, the line for 30 in. might be taken to run as it is drawn. Other lines are drawn for other amounts, as closely as the scale of the map will allow, so that it shows clearly what we wish to show. The same method can be applied to figures for pressure and for temperature. The lines so drawn are known as *iso* or equal lines because they mark equal conditions. Lines marking equal pressure are *isobars*, *bar* signifying weight or pressure. Those marking equal temperatures are *isotherms*, *therm* signifying heat ;

those marking equal precipitation, isohyets, *hyet* signifying moisture. The derivation of all these words is from Greek. Means or averages may be worked out for any period of time for which there are enough observations : but to know the mean temperature over the whole year for any place would tell us very little. It would not show whether the climate were equable, meaning that it was never very hot or very cold, or extreme, meaning that it was sometimes very hot and sometimes very cold. Nor would it tell us anything about the seasons of greatest heat and cold. Therefore temperature observations are usually worked out to show the mean monthly temperature ; that is, the average temperature during the whole of each month in the year. Figures for mean annual rainfall are more valuable than those for mean annual temperature, because when plotted on the map they show at once what parts of the country or of the world are wet or dry ; but again monthly means are necessary to show at what seasons rain mostly falls, which may, as we have seen, be an important question.

*Reduction to Sea-level.*—In making maps of the world or of large countries to show the distribution of temperature and pressure, the figures used are not as a rule the means of those actually observed except for places at sea-level. The temperature of the air decreases, as we know, with height above the surface. The decrease is on an average  $1^{\circ}$  F. for each 300 ft. of ascent in the lower atmosphere. Supposing that in making a temperature map we found the figure of  $60^{\circ}$  F. for a point at sea-level and that of  $40^{\circ}$  F. for another point 6,000 ft. above sea-level, both would be shown on the map as  $60^{\circ}$  F., the figure for the high point being corrected to sea-level. The correction of pressure figures depends not only on height, but on temperature of the air. On an average about one-tenth of an inch has to be added for each one hundred feet in height in order to correct the pressure to sea-level. But why, it may be asked, enter upon a map figures which are not true ? The answer is that our maps are meant to illustrate in a simple way the inferences to be learned from a vast number of examples ; and that, in order to keep the map simple, elevation must be left out of account. But in using the maps it must not be forgotten that this has been done.

*Heat.*—On p. 405 we studied the position of the earth in relation to the sun, and, from that, it is clear that at the Equator and between

the tropics more radiant energy is received from the sun than outside the tropics. The land and water surfaces of the earth behave very differently in regard to the heat they receive from the sun. It takes about twice as much heat to raise the temperature of a bulk of water as it takes to raise the temperature of an equal bulk of land to the same extent. The land surface is a poor conductor of heat, and heat does not enter deeply into the land. A water surface is a good conductor, and heat enters much deeper into water than into land. Water by its movement distributes the heat it receives; the land does not move and distribute in the same way. About half the heat received from the sun by a water surface is used in causing evaporation. This, of course, does not happen to the same extent with the heat received by a land surface. And so, as the land and water surfaces do not use and radiate the heat they receive in the same way, the temperature of the air differs according as the air is above a land or a water surface. In summer, for example, or during a warm day, land is heated more quickly than water; in winter or at night it cools more quickly. The temperature over the land varies more than over the water.

*Equable and Extreme Climates.*—From this it should follow that summers are hotter and winters colder in the interior parts of continents, far from the sea, than they are over the sea itself and in lands near the sea at the same latitudes. And this is so. Our descriptions of the climates of continents in Part I give examples. Let us try to illustrate the point by a map (Fig. 168). A land where the mean temperature of a winter month is  $32^{\circ}$  F. or less must have a cold winter, for  $32^{\circ}$  F. is the freezing-point of water. A land where the mean temperature of a summer month is  $70^{\circ}$  F. or more must have a hot summer. Let us draw isotherms for  $32^{\circ}$  in January and July and for  $70^{\circ}$  in July and January on a map of the world. The principal points to be noticed are these.

Over the North Pacific and North Atlantic oceans and lands bordering them, notably in Europe and including the British Isles, there are areas where the January mean temperature is not so low as  $32^{\circ}$  and the July mean temperature not so high as  $70^{\circ}$ . We take it therefore that the climate of these areas is temperate and equable, that is to say, not subject to great variation of temperature, having summers cool and winters not very cold. Here is seen the influence

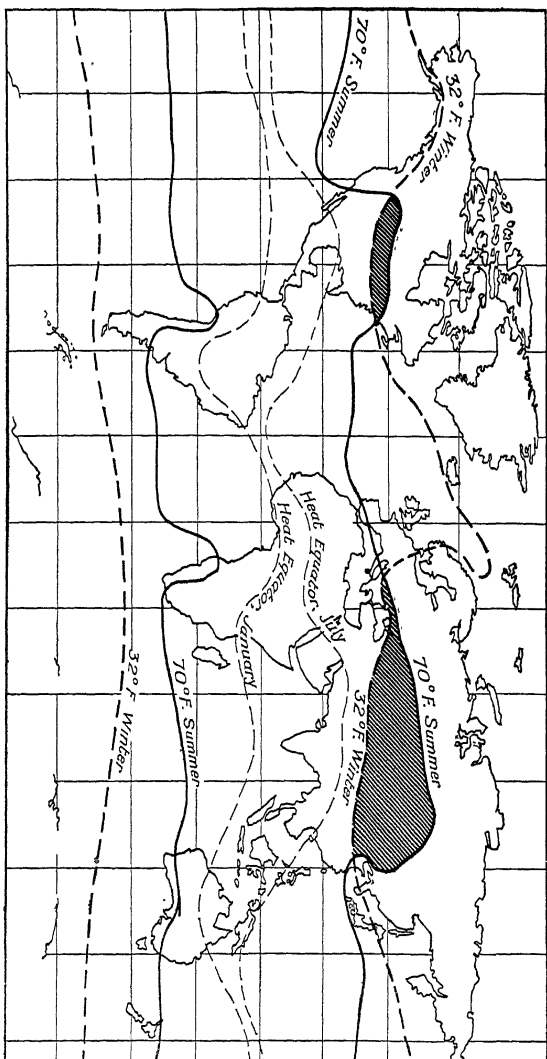


FIG. 168. Regions of equable and extreme temperatures, and the heat equator in July and January.

of the water surface. Over the central portion of North America, and a larger central portion of Europe and Asia, there are regions where the January isotherm of  $32^{\circ}$  runs south of the July isotherm of  $70^{\circ}$ . This shows that these interior continental lands have mean temperatures of  $32^{\circ}$  or less in January but of  $70^{\circ}$  or more in July. They have hot summers and cold winters; in fact, an extreme climate, subject to great variations of temperature; and here is seen the influence of the land surface in contrast with that of the sea. There is not so large an extent of land in the southern hemisphere at latitudes corresponding to these great land areas in the northern, and the winter (July) isotherm is not bent as it is in the northern area by the influence of land and sea. But the same effects are shown, though not so markedly, by the northward bends of the summer (January) isotherm of  $70^{\circ}$  over the ocean and the southward bends over land, showing that it is hotter over land than over sea at the same latitudes. Between the temperate belts of north and south there are, firstly, two belts in which summers are hot and winters not cold, and, secondly, a belt around the earth's middle in which the climate is always hot. This equatorial belt has a climate of the kind which is often called tropical. The climates of the warm belts on either side of it includes those sometimes known as sub-tropical; the areas around the Poles, north and south, have cool, if not cold, summers and cold winters. We have now divided the earth into zones of temperature.

*Ocean Currents and Air Temperatures.*—A strong effect on the temperatures of lands neighbouring to the sea is produced not merely by the water surface itself but by its movements or currents. We will consider these in the next chapter, but notice examples here. The Gulf Stream drift is the slow movement of warm water which originates in the Gulf Stream off the south-eastern coast of North America, and passes across the North Atlantic Ocean northward and eastward. This drift has a very strong effect in giving winter temperatures which are warm, considering the latitude, in the British Isles and in north-western Europe. There is a similar drift across the North Pacific Ocean to the western coast of North America. By way of contrast, there are cool currents flowing along the western shores of Africa both north and south of the Equator, and a similar effect is seen in South America, especially on the south-western coast.

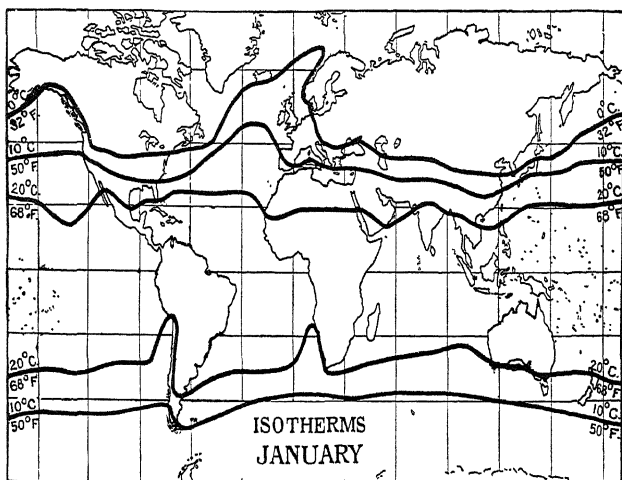


FIG. 169

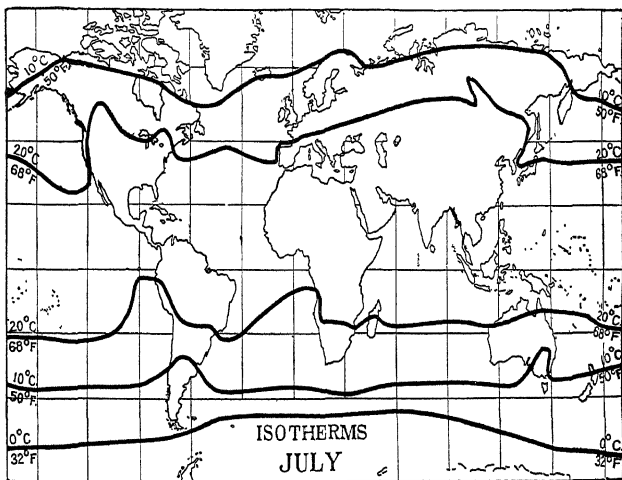


FIG. 170. (The temperatures on which these isotherms were based are as usual reduced to sea-level.)

Much of the coast of south-west Africa is bordered by land which is almost or quite desert, but it is not the very hot desert of which we are accustomed to think in connexion with the Sahara or other dry deserts of the earth (Part I, p. 265).

*World-distribution of Pressure.*—The following are average conditions in the distribution of pressure over the earth :

(1) The constant high temperature of the equatorial belt is accompanied by a belt of constant low pressure.

(2) To the north and south of this belt, roughly about the tropics but rather northward of the northern tropic and southward of the southern, there are belts of relatively higher pressure over the oceans, with the decrease of temperature. These belts actually form a chain of high pressure areas with gaps of lower pressure between them, a fact which we shall find to bear upon the distribution of winds.

(3) In the temperate zones, with winter low temperatures over the land and relatively high temperatures over the sea, there are areas of higher pressure over the land than over the sea.

(4) Conversely, in the same zones, with summer high temperatures over the land and relatively low temperatures over the sea, there are areas of lower pressure over the land than over the sea.

The changes indicated by (3) and (4) are more marked in the northern than in the southern hemisphere because of the greater extent of land in the northern hemisphere ; and most marked over the greatest extent of land, in Asia.

(5) Over the polar regions, conditions are different to the extent that, although temperature is generally lower, pressure is relatively lower also than it is in the tropical belts and the continental areas of high pressure.

*Wind : relation to Pressure.*—The connexion between winds and pressure lies in this : that wind is the movement of the air, and the air moves because, so to say, it is always trying to equalize its pressure. The general wind system of the world seems to be kept up because of the unequal heating of different parts of the atmosphere, and the unequal pressure which results from that. When at any place the wind blows more often from one direction than from any other, the wind from that direction is called the prevailing wind. We shall presently discuss the distribution of these prevailing winds, but the reasons for their origin and distribution are not at all



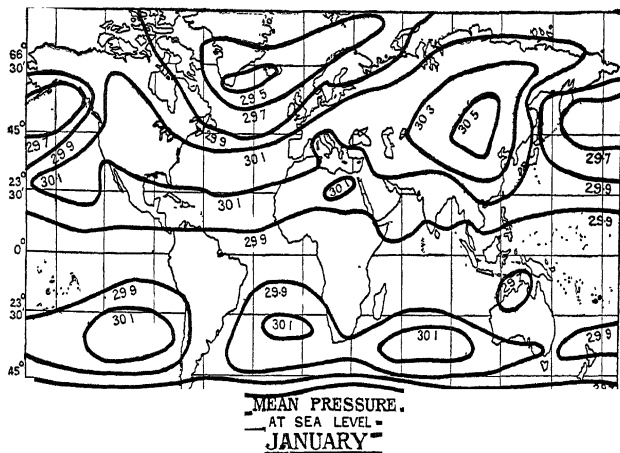


FIG. 171.

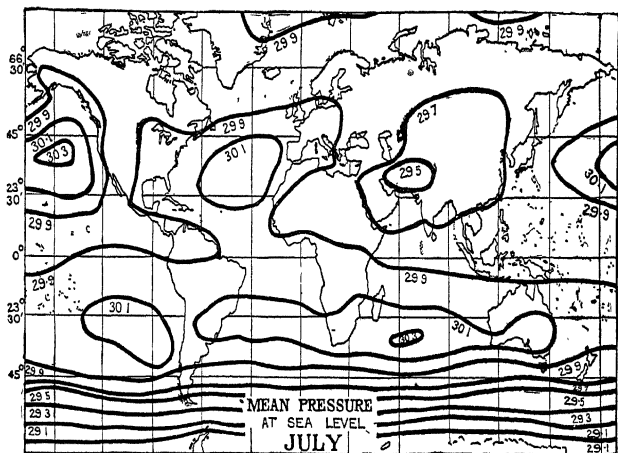


FIG. 172.

thoroughly understood, which is not surprising when one thinks of the difficulties of exploring the air and discovering the behaviour of a fluid which cannot be seen. An easier illustration of the relation between pressure and wind on a smaller scale is given by the so-called land and sea breezes which, in some parts of the world and at some seasons, have quite important effects on man's life. In many hot lands, and in calm, hot, and sunny weather in temperate lands, these land and sea breezes often occur along the coasts. In day-time the land surface heats more quickly than that of the sea, and pressure is lower over the land than over the sea, so that a sea breeze blows from sea to land and cools the excessive heat. At night the land cools more quickly than the sea, and pressure is higher over the land than over the sea, so that after a period of calm toward evening, when pressure is equal over both, the land breeze blows seaward.

From this it appears that the air moves, that is to say that the wind blows, from a region of high pressure to one of low pressure. This might be illustrated by two jars, one full of water and the other empty, connected by a pipe at the bottom, when the water will flow from the full jar to the empty one till it stands equal in both. But we shall find (p. 477) that other forces come into play.

*The Depression and the Anticyclone.*—A complete isobar or series of isobars may enclose an area of low pressure called a depression, cyclone, or low, or an area of high pressure called an anticyclone, or high. The word 'cyclone', as applied to a low-pressure area, may mean a very different system of low pressure according as it is used in temperate or in tropical regions. The depression or cyclone in temperate regions may cover an area many hundreds or even thousands of miles across; but the word cyclone is commonly applied in the tropical regions of the Indian Ocean to violent circular storms accompanying depressions which may measure not more than 50 to 100 miles across. Other names well known as applied to such storms are the hurricanes of the West Indies and South Pacific and the typhoons of the western Pacific and Chinese seas. The word 'tornado' is used in North America of a whirlwind, perhaps only 100 or 200 yards in diameter, but liable to do great damage. The same word is also applied to a violent wind which frequently blows for a short time in western and central Africa at the beginning of

a thunderstorm, passing out from the front of the storm as the rain begins.

A general idea of the structure of a depression in temperate latitudes helps to account for many common features of the weather. Starting with the idea of a steady belt of warm air around the equatorial region, and steady caps of cold air over the polar regions, we have to picture masses of air moving off from this belt and these caps,

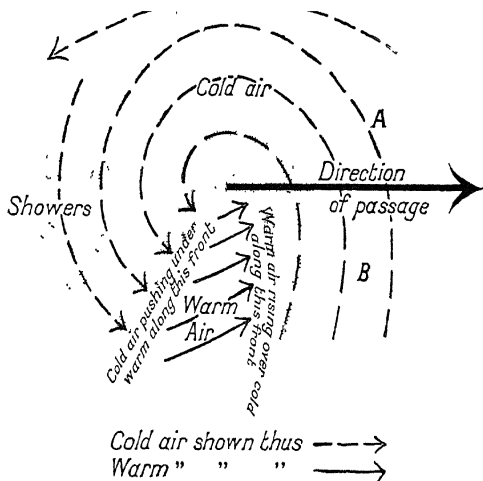


FIG. 173. THE STRUCTURE OF A CYCLONE.

into the temperate regions, where they may meet. Exactly why they so move is not clear. But it is clear what happens when they meet. Taking average conditions of a depression over the British Isles, we find, in the southern part of the depression, a stream of warm air from the south-west or some southerly direction—let us call it, briefly, equatorial air (see Fig. 173). Along a line in the front part of the depression, from the centre eastward and south-eastward, or thereabouts, this south-westerly stream, at the surface, is lost, and its place is taken by a stream of colder air—polar air—from some easterly direction. Hereabouts, steady rain usually falls. The warm equatorial air is rising over the cold polar air, and its moisture is

condensed into cloud and rain. Toward the rear part of the depression there is a line along which the warm equatorial stream gives place again to the cold polar stream, now northerly or north-westerly. The front of the polar stream is here coming up against the side of the equatorial stream, and being colder and heavier is pushing under it. The air conditions become very unstable ; hence squalls and heavy showers commonly occur. This is a simple statement : it must be understood that all sorts of variations from average conditions may take place in the fluid air. It may be said broadly, however, that cyclonic conditions in the temperate zones happen when polar and equatorial air-streams meet ; anticyclonic conditions when they do not. As for the tropical depressions of smaller area, it is not clear how they are formed ; whether as whirls about warm centres, or in the same way as temperate depressions.

The diagram (Fig. 173) represents—but in a very simple and ‘ ideal ’ way—the movement and temperature of the air in a depression passing eastward ; for example, over the North Atlantic Ocean and approaching the British Isles. It will be seen that conditions at points A and B will differ greatly as the depression passes over them. At B there will be two periods of steady rain (which is shown by shading in the diagram) ; these and the warmth, increasing at first, decreasing later, the squalls and ‘ clearing ’ showers, will be experienced in succession. At A there will be only one period of rain, though there may be more of it than at B if nearer to the line of ‘ direction of passage ’.

Anticyclones, broadly speaking, bring light winds or calms and little or no rain. In temperate lands such as Britain, bright warm weather in summer, and dull quiet weather, with fog, in winter, are common with anticyclones.

*Wind-direction and Isobars.*—Depressions and anticyclones are continually forming and passing within the larger average system of distribution of pressure which we have already discussed. On the weather maps arrows are drawn flying with the direction of the wind, pointing, that is, from the direction from which it blows, which is that from which we name the wind. At first thought it might seem that the winds should blow directly from high- to low-pressure areas, and that the arrows should therefore cut directly across the isobars which mark the succeeding stages of pressure,

decreasing or increasing. As a fact the arrows generally point much more nearly along the isobars, and they have always the same general relation to them in the northern hemisphere, and just the opposite relation in the southern hemisphere; such that if in the northern hemisphere you stand with your back to the wind, pressure is lower to your left-hand side than to your right; if in the southern hemisphere, it is lower to your right-hand side than to your left. There are various forces at work upon the winds which give them these directions nearly along the isobars. There is the force which tends to make the air move toward the low pressure from the high; there is the centrifugal force connected with the curve of the path followed by the air over the curved surface of the earth; there is friction with the surface, and there is the tendency of the air, in trying to follow a straight course over the surface, to be turned from that course by the fact that the earth itself is rotating. This last shapes the course of the moving air toward the right in the northern hemisphere and towards the left in the southern.

*The General Wind-system of the World* is this:

(1) Around the Equator, the hot low-pressure belt is a belt of calm or light variable winds—generally, that is. Special local conditions may alter for a time any of the general conditions. This must be always remembered if, for convenience, we speak of a wind-belt around the earth; for over the large land-masses such winds as the trade winds, described below, do not blow regularly as they do over the oceans.

(2) On either side north and south of the equatorial region, about latitudes  $20^{\circ}$  to  $30^{\circ}$ , the Trade Winds blow, generally from some point between north and east in the northern hemisphere, and between south and east in the southern. They are very regular and mild over the oceans, and it is sometimes supposed that they were given their name by sailors in early times who could depend upon them to drive the sailing-ships which were used to carry the world's trade by sea. It seems more probable, however, that the word 'trade' in this connexion has the earlier meaning of a 'path' or 'direction', being connected with the word 'tread' and referring to the fact that these winds follow very definite directions. The trade winds are seen to form part of the circulation around, and trending outward from, the chain of high-pressure areas previously mentioned, and they flow through the gaps between these areas. High-pressure

areas lie to the right of the north-east trade winds in the northern hemisphere, low-pressure areas to the left. High-pressure areas lie to the left in the southern hemisphere and low-pressure areas to the right. The trade winds give the best known illustration, on the largest scale, of the relation of wind and pressure.

(3) Over some parts of the earth about the Tropics, however, the above systems are altered by a system of winds called Monsoons, which blow very regularly in nearly opposite directions at different seasons of the year. The name is derived through Dutch from Portuguese, the Portuguese being the first European explorers (in the modern sense of the word) to observe these winds. The origin of the name is perhaps to be found in an Arabic word meaning 'season'. The monsoons are especially marked over the seas and coastlands of India and south-eastern Asia, where the southerly monsoons blow in summer and the northerly monsoons in winter. Their effects upon the life of man in this region are of tremendous importance. (See Part I, fig. 59).

(4) About latitudes  $40^{\circ}$  to  $50^{\circ}$  or higher, winds from westerly points prevail, but they are much less steady than the trade winds, especially in the northern hemisphere, where the winds are affected by the wide distribution of land just as pressure and temperature are. These westerly winds often blow up to gales, and in the southern hemisphere the belt in which they blow is commonly known as the 'Roaring Forties' from the noise of the winds and the latitude. They are also known from their persistence as the 'Brave West Winds'.

(5) For prevailing winds of the Polar regions there is, naturally, much less information, and they are not well known.

*World-distribution of Rainfall* (Fig. 176).—As the air draws its water vapour in very large proportion by evaporation from the sea it is natural that winds from over the sea will bring the most rain; and it follows that generally, though not always, there is less rain in the interior of continents than in the coastal regions. The great expanse of desert which extends from Central Asia almost without a break to the Sahara in Africa lies for the most part in the interior and in the trade wind zone, where the winds, not passing over any great expanse of sea, are generally dry. The same applies to the Great Basin in the south-west of North America and to the smaller

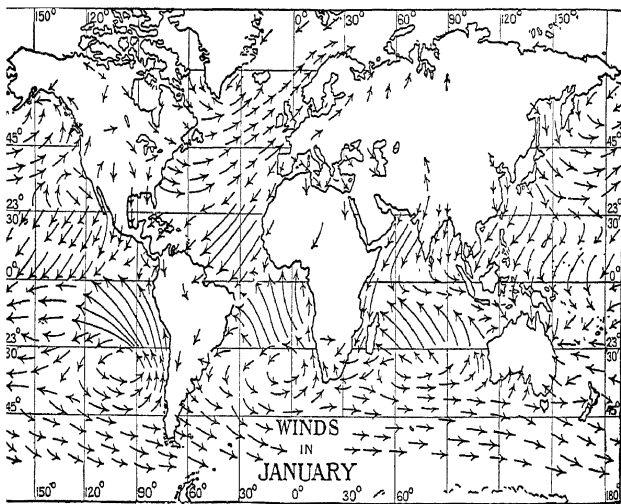


FIG. 174.

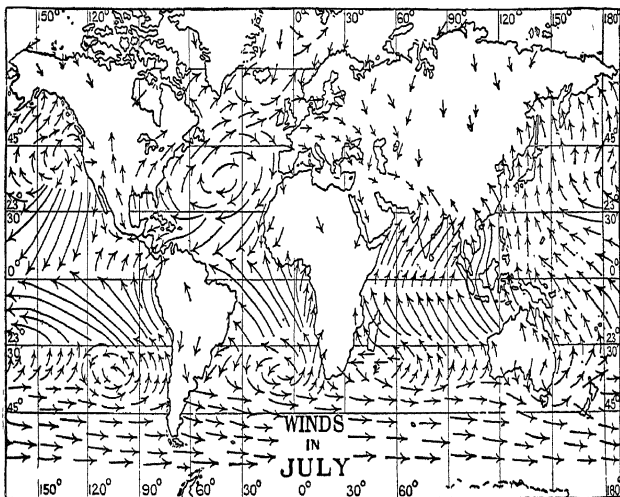


FIG. 175.

deserts of the southern hemisphere, the Atacama in South America, the Kalahari in South Africa, and the arid interior of Australia, which lie on the western sides of these continents. On the contrary, it can be seen even on small maps that a large amount of rain falls in mountain regions facing prevalent winds. Moving air on reaching a mountain-slope is naturally slowed in speed, and if it be carrying rain-showers with it these of course are slowed too, so that more of the rain falls on the mountain-slope than where the air passes freely, without slowing, over the surface. There are other reasons ; this is the simplest and probably the most usual.

*Seasonal Rainfall.*—The following is the general distribution of rainfall according to seasons.

(1) In the equatorial regions there are two periods of the year at which rainfall is heaviest, as (or rather after) the sun passes overhead in its apparent northward and southward passage. Other months are less rainy, but there is no dry season.

(2) In the tropical belts north and south of the Equator there are at first still two wet periods ; but they approach more closely, and the winters when the sun is less high are more noticeably dry, until at the north and the south of the northern and southern belts respectively there is one wet season only, about the solstice, and a dry winter.

(3) In the monsoon regions the summer is wetter as the winds draw in from seaward to the warm land, and the winters are dry as the winds blow outward from land to sea. The grand example of the monsoon system is provided, as we have seen, by India and south-eastern Asia ; but monsoon conditions more or less strong appear elsewhere. The Asiatic system extends in a modified form as far as northern Australia, and monsoon conditions are also found over east Africa, and to some extent in the southern part of North America, bordering the Gulf of Mexico.

(4) The Mediterranean region, and those which by their likeness to it are known also as Mediterranean regions—in the south-west of North and South America (California, Central Chile), around the Cape of Good Hope in South Africa, and in parts of southern Australia—are transitional between the trade wind belt and that of the prevailing westerlies. They come within the influence of the Trades in summer when these are dry, and within the influence of the westerlies in winter, so the winter is a wet season.



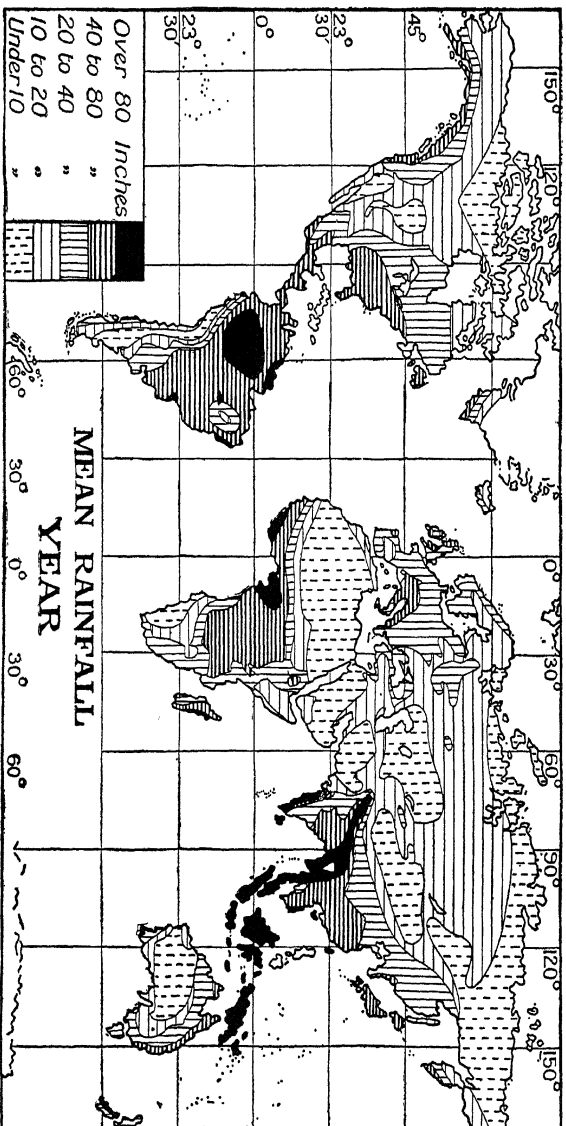


FIG. 176. MEAN ANNUAL RAINFALL.

(5) The interiors of continents in the temperate regions have generally most rain in summer, and notably in the spring and early summer, in such districts as the European steppes and the prairies of North America—a fact which is important to the cultivation of wheat in these regions—but the division into wet and dry seasons is less marked than in the monsoon or Mediterranean regions.

(6) In the regions exposed to prevalent westerly winds from over the oceans there is no division into wet and dry seasons.

*Air Communications.*—The study of air communications must become more and more important in geography. Communication by aeroplane is already most useful, firstly, in countries and between big towns where the quickest form of transport is valuable for people doing business and for mails. Thus we find aeroplane connexions established between London, Paris, Brussels, Cologne, Berlin, Prag, Vienna, Belgrade, Constantinople, Warsaw, Moscow, and other centres in Europe; and also across North America between New York, Chicago, San Francisco, &c. Secondly, air communications may be important where the other means of transport are slow or difficult; especially, of course, where there are no direct railways. So we find aeroplane services worked from Egypt to Iraq (Baghdad and Basra) and on to India; between some of the chief producing centres in Russian Turkistan; between France and the French possessions in Algeria and West Africa (skirting the desert coast of Africa); northward from Perth to the more distant settlements in Western Australia, and between certain points without direct rail-connexion in the east of Australia. Examples such as these become yearly more numerous. No doubt the time cannot be far distant when airships will connect Britain with all the principal territories of the British Empire: plans are in the making for communications between England (see Part I, p. 53) and India, Australia, South Africa, Canada, and the West Indies. An airship service would be expected to save at least three or four days over a steamer voyage from England to Canada, ten days to India, a fortnight to South Africa, and three weeks to Australia. The study of the air becomes of first-rate importance in this connexion. ‘The air and its currents’, it has been said, ‘are to the aircraft what the oceans and their currents are to the ships, and in the same way as the task of charting the sea has proceeded for generations, so the upper air must be

charted if aerial transport is to be carried out with regularity and safety '—a new and fine work in meteorology and geography. Aircraft, with their high speeds, can travel around a stormy part of the air more easily than steamers can avoid stormy seas, and the close study of the air will aim to tell air-pilots where dangerous conditions, such as tornadoes and the violent vertical air-movements connected with thunderstorms, are to be expected.

## EXAMPLES OF MEAN TEMPERATURE AND RAINFALL

### § 1. *Comparison of West-coastal, Interior, and East-coastal Conditions in the Temperate Belt of the Northern Hemisphere.*

(TABLE I)

(1) *Valencia*, SW. coast Ireland. Full exposure to Atlantic westerly winds. (2) *London*. Distinctly warmer summers and colder winters than (1), and a lighter rainfall. (3) *Seathwaite* in the Lake District, a hill-country facing the Irish Sea to the west of it : rainfall only is quoted to illustrate highest average recorded in England. (4) *Warsaw*, Central Europe. Greater extremes of temperature ; summer maximum rainfall in contrast with rain at all seasons at 1-3. (5) *Semipalatinsk*, Central Asia. Extremes and dryness more marked. (6) *Vladivostok*, E. coast of Asia ; farther south than preceding examples, but severe winter, summer heat modified by sea, and moderate rainfall of this coast, are illustrated. (7) *Victoria*, Canada ; Pacific (west) coast conditions of equable temperature ; rainfall well distributed and three times greater than (8) *Kamloops* in dry belt of British Columbia, where temperatures are higher, especially in winter, than at (9) *Winnipeg* on the central plains. The spring-summer rainfall is to be noticed here. (10) *St. John's*, Newfoundland, illustrates the Atlantic (eastern) coast of North America in these latitudes.

Some further examples of coastal temperatures (Table Ia), at a rather higher latitude, are added : (11) *Orkney Islands*, Scotland, and (12) *Sitka*, Alaska, on western ocean coasts, in contrast with (13) *Nain*, Labrador, and (14) *Okhotsk*, Siberia, on eastern ; with (15) *Stockholm* on the Baltic as illustrating intermediate conditions accompanying a smaller expanse of sea, and oceanic influence still

visible. (16) *Verkhoyansk* (elevation 330 ft.) represents the most extreme annual range recorded ; this is in the interior of northern Asia.

### § 2. *Mediterranean Types.* (TABLE II)

Hot dry summers, mild winters, most rain in winter half of year, with one maximum period, or two. Madrid and Milan are included for contrast with Mediterranean conditions proper ; Durban, with its heavy summer rainfall, for contrast with Cape Town.

### § 3. *Monsoon Rainfall.* (TABLE III)

Examples are given from India : west coast (30), north-east coast (31), Indo-Gangetic plain (32), the arid north-west (33), the hill-country in the north-east where the highest known mean rainfall is recorded (34), and the south-east, where the heaviest rainfall is in winter months. A general idea of the relation between the wet and dry and the hot and cool seasons is provided by the temperature example in (55). There are added, outside India, figures for Hong-Kong, Shanghai (where monsoon conditions are not so well marked), and Peking ; and for the east coast of the main island of Japan (39), to which for contrast is added a west-coast example (40) with winter rains. An example of the East African monsoon region is given from Abyssinia (41), illustrating the rainfall which is so important as a cause of the Nile floods. The monsoon in northern Australia is illustrated in (42) the months being rearranged for comparison in accordance with southern seasons.

### § 4. *Equatorial and Tropical Rainfall.* (TABLE IV)

In Africa and America. About the Equator, two periods of heaviest rainfall following periods when sun is overhead (47, 48) ; farther from the Equator, and nearer the Tropics or ' turning points ' of the sun, these two periods approach more nearly (45, 46), until, still nearer the Tropics, there is only one such period (43, 44 ; 49, 50).

### § 5. *Temperature and Elevation.* (TABLE V)

Some comparisons are given between the temperatures of places at different heights : in Scotland (51 and 52) ; in the region of the

Alps (53 and 54); in India (55, 56, showing a reason why British people who live there go to 'the hills'—represented by Simla—in the hot season if they can); in East Africa (57-59, where Nairobi, in Kenya, represents a district close to the Equator, but fitted by its elevation for settlement by white people), and in the northern Andes of South America (60, 61). It will be seen that in these examples elevation has little or no effect on annual range.

TABLE I

*Temperature, ° Fahr.*

	<i>Lat.</i>	<i>Long.</i>	<i>Height, Ft.</i>	<i>Jan.</i>	<i>Feb.</i>	<i>Mar.</i>
(1) Valencia	51° 56' N.	10° 15' W.	30	44·4	44·3	45
(2) London	51° 28' N.	0°	18	38·4	40	42·4
(4) Warsaw	52° 13' N.	21° 2' E.	390	25·5	27·5	34
(5) Semipalatinsk	50° 26' N.	80° 13' E.	590	0·5	1·8	14·4
(6) Vladivostok	43° 7' N.	131° 55' E.	50	8	14	27·1
(7) Victoria	48° 24' N.	123° 19' W.	85	39·5	39·7	42·6
(8) Kamloops	50° 41' N.	120° 29' W.	1193	22·4	26·4	37·5
(9) Winnipeg	49° 53' N.	97° 7' W.	1492	-4·4	-0·5	14·3
(10) St. John's, Nfd.	47° 34' N.	52° 42' W.	125	24·3	23·3	28·4

*Rainfall, inches.*

	<i>Jan.</i>	<i>Feb.</i>	<i>Mar.</i>	<i>Apr.</i>	<i>May.</i>
(1) Valencia	5·8	5·2	4·4	3·8	
(2) London	1·8	1·5	1·6	1·6	1·9
(3) Seathwaite <sup>1</sup>	13·4	11	10·6	6·9	7·5
(4) Warsaw	1·2	1·1	1·3	1·5	1·9
(5) Semipalatinsk	0·5	0·2	0·4	0·4	0·8
(6) Vladivostok	0·1	0·2	0·3	1·2	1·3
(7) Victoria	4·8	3·5	2·5	1·7	1·2
(8) Kamloops	0·9	0·8	0·4	0·3	1
(9) Winnipeg	0·9	0·8	1·3	1·6	2·2
(10) St. John's	6·3	5·7	4·7	4·3	

TABLE I a

*Temperature.*

	<i>Lat.</i>	<i>Long.</i>	<i>Jan.</i>	<i>Feb.</i>	<i>Mar.</i>	
(11) Orkney	59° N.	3° W.	39	38·5	39·3	42·4
(12) Sitka	56° 50' N.	135° W.	30·2	31·8	34·5	39·7
(13) Nain	56° 25' N.	62° W.	-7·1	-3·4	6·4	20·1
(14) Okhotsk	59° N.	143° E.	-10·5	-7·2	6·6	21·4
(15) Stockholm	59° 17' N.	18° E.	26·6	25·7	28·9	37·8
(16) Verkhoyansk	67° 30' N.	134° E.	-58·9	-47·4	-24	7·3

Elevation 422 ft. See also Fort William and Ben Nevis, examples 51, 52.

TABLE I

*Temperature, °Fahr.*

<i>Apr.</i>	<i>May</i>	<i>June</i>	<i>July</i>	<i>Aug.</i>	<i>Sept.</i>	<i>Oct.</i>	<i>Nov.</i>	<i>Dec.</i>	<i>Range</i>
48	52.1	56.6	58.8	58.8	56.6	51.4	47.4	45.5	14.5 (1)
48	54	60.2	63.6	63	58.2	50.5	43.5	40	25.2 (2)
45.6	56.1	63.8	66	64.2	56.6	46.4	35.3	27.8	40.5 (4)
38.3	57.2	68	72	67.3	54.9	38.1	20.1	6.1	71.5 (5)
39.8	49.3	57	65.2	69.3	61.9	49	30.5	14	61.3 (6)
47.2	52.5	56.4	59.7	59.5	55	49.9	43.9	41	20.2 (7)
49.6	57.5	64.5	69.6	68.1	58.4	47.8	35.7	29	47.2 (8)
37.7	51.6	62.2	66.2	63	53.5	40.8	20.8	5.7	70.6 (9)
35.4	42.8	49.6	58.8	59.3	53.6	45.3	37.5	29	36 (10)

*Rainfall, inches.*

<i>June</i>	<i>July</i>	<i>Aug.</i>	<i>Sept.</i>	<i>Oct.</i>	<i>Nov.</i>	<i>Dec.</i>	<i>Mean Annual</i>
3.5	3.9	4.8	4.3	5.7	5.4	6.4	56.3 (1)
2	2.3	2.3	2.2	2.7	2.3	2	24.2 (2)
6.9	8.9	11.5	11.3	12.7	13.6	15.2	129.5 (3)
2.7	3	3.1	1.9	1.7	1.5	1.4	22.3
0.9	1.1	0.4	0.6	0.6	0.6	0.8	7.3
1.5	2.2	3.5	2.4	1.6	0.5	0.2	14.7
1	0.4	0.6	1.8	2.9	5.5	5.6	31.5 (7)
1.2	1.2	1	1	0.5	1.1	0.8	10.2 (8)
3.3	3.2	2.2	1.9	1.4	1	0.9	20.7 (9)
3.9	3.6	3.7	3.5	6.2	6	5.4	56.5 (10)

TABLE I a

*Temperature.*

<i>May</i>	<i>June</i>	<i>July</i>	<i>Aug.</i>	<i>Sept.</i>	<i>Oct.</i>	<i>Nov.</i>	<i>Dec.</i>	<i>Range</i>
46.4	51.3	54.2	54	51.5	46.4	42.4	39.7	(11)
45.9	51.3	54.5	54.7	50.5	43.9	37.4	32.9	24.5 (12)
	40.1	51.8	48.3	41.5	37.4	18.8	2.3	58.9 (13)
	45.3	54.9	55.2	46.4	26.6	5.5	-7.8	65.7 (14)
47.3	57.4	62.1	59.5	52.7	43.0	34.9	28.4	36.4 (15)
35.4	54.5	59.5	49.8	36.3	5.2	-34.4	-52.6	118.4 (16)

TABLE II

*Temperature.*

<i>Europe</i>	<i>Height, Ft.</i>	<i>Jan.</i>	<i>Feb.</i>	<i>Mar.</i>	<i>Apr.</i>	<i>May</i>
(17) Genoa	177	45.5	47.7	51.5	57.6	63.3
(18) Nice	66	46.4	47.5	50.7	56.5	62.2
(19) Corfu	98	50.4	51.1	53.2	59.7	66.4
(20) Athens	351	46.7	48.3	52.3	58.6	67.2
(21) Madrid	2149	40.6	44	48.3	54	60.6
(22) Milan	482	32.4	38.1	46	55.2	62.6
<i>Africa</i>						
(23) Algiers	470	49.1	50.3	52.5	56	60.6
(24) Alexandria	105	57.3	59.3	62	66.2	71.2
<i>North America</i>						
(25) San Francisco	207	49.5	51.3	52.7	53.7	55.5

*Southern Hemisphere* (months reversed for easier comparison of seasons).

<i>Africa</i>	<i>Height, Ft.</i>	<i>July</i>	<i>Aug.</i>	<i>Sept.</i>	<i>Oct.</i>	<i>Nov.</i>
(26) Cape Town	40	54.8	55.6	57	60.7	64.2
(27) Durban	260	64.4	66	67.6	69.4	72.6
<i>S. America</i>						
(28) Santiago	1703	46.9	48.4	54.5	56.3	61.3
<i>Australia</i>						
(29) Adelaide	140	51.5	53.8	57	61.9	67



TABLE II

*Temperature.*

<i>June</i>	<i>July</i>	<i>Aug.</i>	<i>Sept.</i>	<i>Oct.</i>	<i>Nov.</i>	<i>Dec.</i>	<i>Range</i>
70	75.4	75.2	70.7	62.1	53.2	47.3	29.9 (17)
69.1	73.8	73.2	68.2	61	52.7	47.3	27.4 (18)
73.6	78.4	78.6	74.3	67.8	59.4	53.4	28.2 (19)
75	80.2	79.7	73.7	66	57.2	50.7	33.5 (20)
68.7	76	75.9	67.6	52.8	47.7	41.2	35.4 (21)
70	74.8	73	66	55.6	44.1	35.6	42.4 (22)
68	73.2	74.6	70	64.2	57.2	51.8	25.5 (23)
75.7	79.7	80.5	78.2	75	68.3	61.2	23.2 (24)
57	57.3	58	59.3	58.4	55.5	50.9	9.8 (25)

<i>Dec.</i>	<i>Jan.</i>	<i>Feb.</i>	<i>Mar.</i>	<i>Apr.</i>	<i>May</i>	<i>June</i>	<i>Range</i>
67.3	69.8	70	68.2	63.1	58.9	55.5	15.2 (26)
75	76.6	77	75	72	67.8	65	12.6 (27)
65.2	67.7	66.8	63.2	56.7	51.7	48.3	(28)
71.1	74.2	74	69.9	64	57.7	53.4	22.7 (29)

TABLE II (*continued*).*Rainfall.*

	<i>Jan.</i>	<i>Feb.</i>	<i>Mar.</i>	<i>Apr.</i>	<i>May</i>	<i>June</i>
(17) Genoa	4.2	4.3	4.1	4.1	3.4	2.7
(18) Nice	2.8	2.2	2.7	3.5	3.2	1.8
(19) Corfu	6.3	5.9	4.3	3	2.1	0.9
(20) Athens	2	1.5	1.3	0.8	0.8	0.7
(21) Madrid	1.3	1.1	1.8	1.9	1.8	1.1
(22) Milan	2.4	2.3	2.7	3.4	4.1	3.3
(23) Algiers	4.2	3.5	3.5	2.3	1.3	0.6
(24) Alexandria	2.2	0.9	0.5	0.2	0	0
(25) San Francisco	4.8	3.6	3.3	1.7	0.7	0

	<i>July</i>	<i>Aug.</i>	<i>Sept.</i>	<i>Oct.</i>	<i>Nov.</i>	<i>Dec.</i>
(26) Cape Town	3.5	3.3	2.2	1.6	1.1	0.8
(27) Durban	0.8	2	3.7	4.9	4.4	4.5
(28) Santiago	3.4	2.4	1.2	0.6	0.2	0.2
(29) Adelaide	2.6	2.4	1.8	1.8	1	0.8

TABLE III

*Rainfall.*

	<i>Jan.</i>	<i>Feb.</i>	<i>Mar.</i>	<i>Apr.</i>	<i>May</i>	<i>June</i>
(30) Bombay	0.1	0	0	0.1	0.5	18.5
(31) Calcutta	0.3	1	1.1	1.5	5.6	11
(32) Delhi	1	0.6	0.7	0.3	0.7	3.2
(33) Jacobabad	0.3	0.3	0.2	0.2	0.2	0.1
(34) Cherrapunji	0.5	2.9	9.8	31.8	50.9	93.2
(35) Madras	0.9	0.3	0.4	0.7	1.9	2
(36) Hong-Kong	1.3	1.6	2.8	5.4	11.6	16.1
(37) Shanghai	2.2	2.3	3.4	3.8	3.7	6.5
(38) Peking	0.1	0.2	0.2	0.6	1.4	3
(39) Tokyo	3.2	2.8	4.4	5	6	6.5
(40) Kanarawa	10.8	6.8	6.2	6.7	6.1	6.6
(41) Addis Ababa	0.6	1.5	2.8	3.2	2.5	5.6

	<i>July</i>	<i>Aug.</i>	<i>Sept.</i>	<i>Oct.</i>	<i>Nov.</i>	<i>Dec.</i>
(42) Darwin				2.1	5.2	10.3

TABLE II (*continued*).*Rainfall.*

<i>July</i>	<i>Aug.</i>	<i>Sept.</i>	<i>Oct.</i>	<i>Nov.</i>	<i>Dec.</i>	<i>Mean Annual</i>	
	2.4	5	7.8	7.4	4.8	51.8	(17)
	1	2.6	6.3	4.4	2.8	33.7	(18)
		3.5	6.3	8.5	9.7	6	
		0.6	1.7	2.9	2.4		
0.5	0.5	1.3	1.8	1.9	1.6	16.6	(21)
2.8	3.2	3.5	4.7	4.3	3	39.7	(22)
0.1	0.3	1.1		4.6	5.4	30	(23)
0	0	0		1.4	2.6	8.1	(24)
0	0			2.6	4.7	22.7	(25)

<i>Jan.</i>	<i>Feb.</i>	<i>Mar.</i>	<i>Apr.</i>	<i>May</i>	<i>June</i>	<i>Mean Annual</i>	
0.7	0.6	0.9	1.8	3.9	4.4	24.8	(26)
4.6	4.5	4.6	3	2	0.7	39.7	(27)
0	0.1	0.2	0.6	2.3	3.2	14.4	(28)
0.8	0.6	1.1	1.8	2.8	3	20.6	(29)

TABLE III

*Rainfall.*

<i>July</i>	<i>Aug.</i>	<i>Sept.</i>	<i>Oct.</i>	<i>Nov.</i>	<i>Dec.</i>	<i>Mean Annual</i>	
25.2	14.2	10.9	1.8	0.5	0.1	71.9	(30)
12.3	12.7	10.4	3.9	0.6	0.3	60.8	(31)
8.4	7.4	4.4	0.4	0.1	0.4	27.7	(32)
1.2	1.2	0.2	0	0.1	0.2	4.1	(33)
99.6	82.5	35.2	21.9	2.9	0.4	431.6	(34)
8	4.7	4.8	10.9	13.0	5.3	48.7	(35)
	14.1	10	4.8	1.7	1.1	83.9	(36)
5.5	5.9	4.7	3.2	1.7	1.2	44	(37)
9.4	6.3	2.6	0.6	0.3	0.1	24.9	(38)
5.5	5.2	8.5	7.2	3.9	2.1	60.3	(39)
8.2	7.1	8.8	7.5	10.5	14.4	99.7	(40)
11.2	11.9	6.4	0.6	0.7	0.1	47.1	(41)

<i>Jan.</i>	<i>Feb.</i>	<i>Mar.</i>	<i>Apr.</i>	<i>May</i>	<i>June</i>	<i>Mean Annual</i>	
15.8	13	9.7	4.5	0.7	0.2	62.5	(42)

TABLE IV

*Rainfall.*

	<i>Lat.</i>	<i>Jan.</i>	<i>Feb.</i>	
(43) Mexico City (N. America)	19° 26' N.	0·1	0·3	
(44) Khartoum (Africa)	15° 36' N.	0	0	0
(45) Cartagena (S. America)	10° 22' N.	0	0	0·1
(46) Mobaye (Africa, Congo basin)	5° N.	0·2	1·7	3·9
(47) Libreville (Africa)	0° 30' N.	8·9	8·5	
(48) Manaus (S. Amer., Amazon basin)	3° 15' S.	9·8	9·6	
(49) Kalomo (Africa)	10° 25' S.	7·6	7·1	2·2
(50) Ouro Preto (S. America)	20° 18' S.	16·6	15	10·8

TABLE V

*Temperature.*

	<i>Height, Ft.</i>	<i>Jan.</i>	<i>Feb.</i>	<i>Mar.</i>	<i>Apr.</i>	<i>May</i>
(51) Ben Nevis, foot (Fort William)	171	38·7	38·8	40·4	45·1	49·7
(52) Ben Nevis, top	4,406	23·4	24·1	24·3	28·3	33·2
(53) Basle	909	31·8	36	40·8	49·3	56·1
(54) Santis	8,202	16·2	16·3	16·9	23·5	30·6
(55) Delhi	718	57·9	62·2	74·1	86·2	91·7
(56) Simla	7,232	38·8	40·6	51·5	59·3	66
(57) Mombasa (E. coast)	50	79·9	80·3	81·8	80·6	78·4
(58) Nairobi	5,450	63·8	64·7	65·2	63·9	63·4
(59) Kisumu (L. Victoria)	3,800	76·9	76·1	75·4	73·3	73·4
(60) La Guaira (coast)	0	78·4	78·4	79·3	80·2	81·1
(61) Bogota	8,730	57·6	57·9	58·6	58·6	58·5

TABLE IV

*Rainfall.*

<i>Apr.</i>	<i>May</i>	<i>June</i>	<i>July</i>	<i>Aug.</i>	<i>Sept.</i>	<i>Oct.</i>	<i>Nov.</i>	<i>Dec.</i>	<i>Mean Annual</i>
	1.8	3.9	4.4		3.9	1.6	0.4		22.4 (43)
0	0.1	0.3	1.7	<u>2</u>	0.5	0.3	0	0	4.9 (44)
0.1	4.3	<u>5.3</u>	3.2	5.3	5.3	<u>8.8</u>	4.6	0.6	37.6 (45)
5.7	5.1	<u>9.6</u>	4.7	9.1	<u>10.5</u>	<u>8.3</u>	4.8	0.9	64.5 (46)
12.8	7.8	0.3	0.1	0.7	3.9	14		9.7	94.8 (47)
	7.5	5.1	3	1.8	1.5	3.9		<u>10.3</u>	83.7 (48)
0.5	0	0		0	1.1		3.6	7.2	30.1 (49)
4.1					3.3		9.3	10.2	79.5 (50)

TABLE V

*Temperature.*

<i>June</i>	<i>July</i>	<i>Aug.</i>	<i>Sept.</i>	<i>Oct.</i>	<i>Nov.</i>	<i>Dec.</i>	<i>Range</i>
55.4	57.1	56.5	53.2	46.6	44	40.1	18.4 (51)
40	41.7	40.8	38	31.4	29.5	25.7	18.3 (52)
62.8	66.4	64.6	58.6	48.6	40.6	33.1	34.6 (53)
	41	40.5	37.2	28.9	22.8	17.4	24.8 (54)
92.2	86.4	84.5	83.9	78.5	67.6	59.6	34.3 (55)
66.9	64.3	62.8	60.9	56.7	50.1	43.4	28.1 (56)
76.5	75.3	75.7	77	78.4	79.4	79.9	6.5 (57)
61.6	58.5	59.3	61.6	64.8	64	62.3	6.7 (58)
72.5	71.8	71.7	73.3	75.4	74.8	76.2	5.2 (59)
81.7	81.1	82.6	82.9	82.6	81.5	78.8	4.5 (60)
58.1	57.2	57	57	57.9	58.3	58.1	1.6 (61)

## XVI. THE SEA

*The Ocean Floor* falls into three divisions. By far the greater part is taken up by the 'deep sea plain', which lies at depths between 12,000 ft. and 18,000 ft. The depressions in this plain are called 'deeps' and lie mostly on the margins of the oceans. In the Atlantic the greatest depth is over 5 miles and in the Pacific nearly 6 miles. Besides these troughs or depressions there are ridges running across the ocean floor, but these are found chiefly in the Pacific, and not so much in other oceans. The Atlantic Ocean, which opens to the Arctic Ocean in the north and the Antarctic or Southern Ocean in the south, has an irregular shape. The bulging of South America and Africa causes it to be rather narrow near the Equator, but it widens out towards the north. It has a number of seas on its margins. On the western side are the Gulf of Mexico and the Caribbean Sea, and on the east the Mediterranean. These are deep seas lying mostly in the tropics. The shallow Baffin Bay and Hudson Bay lie to the north-west and the North Sea and the Baltic to the north-east.

The Atlantic has a very definite continental shelf, widest in the north. The fishing-grounds off north-west Europe and off Newfoundland are on this shelf.

There are very few islands in this ocean, and this is in marked contrast to the Pacific, which has many. The deepest part of the Atlantic Ocean is near the West Indies; Blake Deep, off Porto Rico, measures 4,561 fathoms (1 fathom = 6 ft.).

The Pacific Ocean is shaped like a triangle with curved sides and a wide base in the south, opening to the Antarctic. In the north it is almost closed, for the Bering Strait is very narrow. The seas bordering the Pacific on the western side are cut off from the ocean by the string of islands which fringe the eastern margin of Asia. Toward the north are the Sea of Okhotsk, the Sea of Japan, and the Yellow Sea, and near the Equator we find the China Sea and a number of smaller seas among the islands of the East Indies. The Pacific is deeper than the Atlantic Ocean: the greatest known depth—found near the Philippines—is about 5,300 fathoms. The continental shelf is generally narrow in the Pacific, but there are a large

number of ridges or submarine plateaus which rise, at their summits, into islands. Many of these oceanic islands, as they are called, are formed of coral or of volcanic material (Part I, p. 383). Those islands, which are merely portions cut off from some mainland, are termed continental.

*The Water of the Oceans* is never still. The movement is caused chiefly by the wind and the effect of the tides, but some of it is due to the differences in salinity (saltness) and differences in temperature of the water. Cold water tends to sink and warmer water to rise to the surface and there is the same difference between very salt water and fresher water.

*The Salinity* of the oceans is not everywhere the same. On the average, out of a thousand parts of water, 35 parts (written  $35^{\circ}/_{\infty}$ ) are dissolved salts. About 27 of these parts are formed by sodium chloride, and the remaining 8 parts are mostly magnesium and calcium salts. Probably most of these salts have been brought down from the land by rivers, but there is a great difference between the salts of river water and those of the sea. In the former, the most abundant compound is calcium carbonate (lime) and this occurs only in small quantities in sea-water. But the absence of lime in sea-water may be due to the fact that many animals of the sea use it to form their shells and skeletons. The amount of salt in the water of any part of the ocean depends upon the rate of evaporation and upon the supply of fresh water.

The greatest salinity is found in the areas which lie close to the tropic lines of Cancer and Capricorn. Here the hot sun causes rapid evaporation and there is very small rainfall. Although it is very hot at the Equator, there is much cloud and heavy rain, so the salinity is lower. From the Tropics towards the poles there is a decrease. Areas of low salinity are found near mouths of rivers which supply large quantities of fresh water. In polar regions salinity is low owing to inflow of fresh water and lack of evaporation. Great differences are found in seas which are partially or wholly enclosed. In the Mediterranean there is an increase towards the east where the salinity is  $41^{\circ}/_{\infty}$ . The waters of the Baltic are nearly fresh, the salinity in the north being only  $2^{\circ}/_{\infty}$ . The Mediterranean is in low latitudes and the Baltic receives large supplies of fresh water.

In inland seas and lakes the variations are considerable. If the loss by evaporation exceeds the supply of fresh water, the sea or lake gradually becomes more salt. The saltiest of so-called seas is the Dead Sea in which the salinity reaches  $237.5^{\circ}/_{\infty}$ , but in the driest parts of the globe are found other salt lakes which have a higher salinity.

*Temperature.*—We should expect the temperature of the surface water to be highest near the Equator and to decrease towards the poles. In general this is true, but in many parts of the ocean the temperature varies considerably in the same latitude. For example, off the west coast of Norway the water does not freeze in winter but it does in the Baltic, farther to the south. To some extent this is due to differences in salinity, for ordinary sea-water freezes at about  $29^{\circ}$  F. The water of the Baltic, being nearly fresh, freezes at a higher temperature. But a more important influence is that of the wind which helps to set up currents.

*Currents.*—As in the air (p. 472), however, so in the waters of the ocean, the differences in the sun's radiation at different latitudes is the first cause of currents, as distinct from the tidal movements to be considered presently. Prevalent winds, themselves dependent on that radiation, help to maintain the surface currents of the sea. The waters, having different temperatures not only as between north and south, but also as between the surface and greater depths (for the sun's heat does not penetrate far), become here warm and light, there cold and heavy, and so movement goes on in the attempt to reach equilibrium. The earth's rotation has its effects upon ocean currents as upon the winds (p. 477). Such features as depth or shallowness, and the type of coast, affect currents locally. In the northern part of the Atlantic the prevalent south-westerly winds cause warm waters to be blown toward Europe. On the American side cold water takes the place of the warm. In the region of the trade winds the warm water is driven in the opposite direction toward South America. In the South Atlantic, the south-west of South Africa gets some benefit of warm waters because it lies in the path of the westerly winds.

When these currents strike against the coasts they are turned and in this way a circulation is set up. In the Atlantic there are two such circulations—one north of the Equator and one south. Near



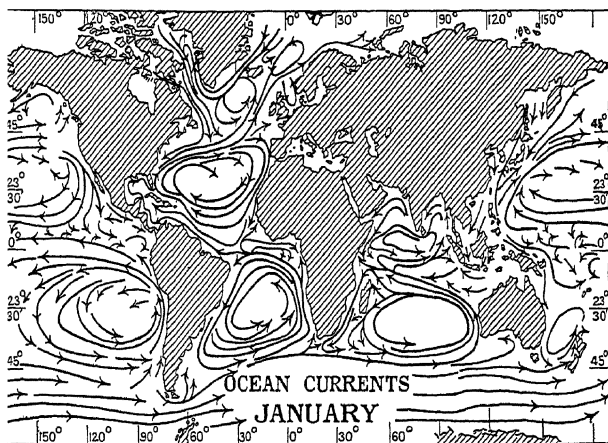


FIG. 177.

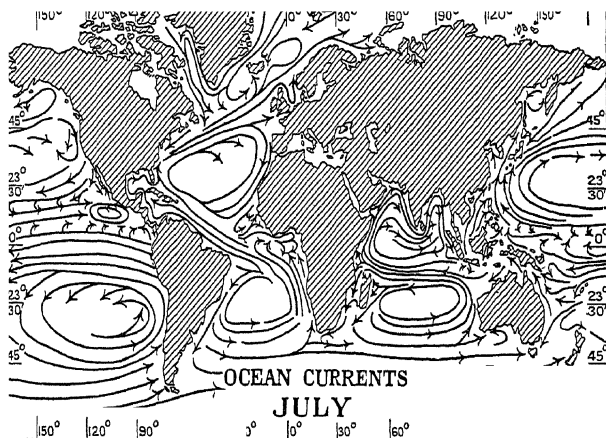


FIG. 178.

the Equator, both on the north and south side, the flow is from east to west, but the level is restored by a counter current flowing in the opposite direction. The general circulation of the North and South Atlantic can be more easily understood by means of a diagram. The north equatorial and south equatorial currents are definite currents because the trade winds blow with more regularity than other winds. The former divides at the West Indies. A part enters the Gulf of Mexico, and emerges as the Gulf Stream. The reunited current moves northward along the east coast of North America, and meets the cold Labrador current off Newfoundland. The meeting dissipates or stops both currents ; but some warm water is carried as the west-wind drift across the North Atlantic Ocean. A part of this warm water finds its way towards the Arctic, but the greater part turns southward to join the north equatorial current and so completes the circulation. In the north two cold currents flow southward : the Greenland and Labrador currents. The relation of the Labrador current with the Newfoundland fisheries has been noticed (Part I, p. 315).

The waters of the North Atlantic circulate around the Sargasso Sea. In the middle of this circulation there is little movement of the waters and this allows the growth of floating seaweed.

The directions of the currents in the South Atlantic are influenced by the south-east trades and westerly winds. Owing to the shape of the east coast of South America, a portion of the south equatorial current is turned northward and joins the north equatorial current. The other portion turns southward as the Brazil current, and later, under the influence of the westerly winds, is carried across to the west coast of Africa. As the Benguella current it flows northward and completes the circulation by joining the south equatorial current. In the southern hemisphere there is little land to stop the drift of waters in latitudes south of  $40^{\circ}$  S. Here the eastward movement of waters is called the Antarctic drift.

In the Pacific Ocean the circulation of waters is very similar to that of the Atlantic, but in the Indian Ocean there are seasonal changes in the direction of the winds (see p. 478, on the Monsoons) and the currents change their direction accordingly. In the winter the north-east monsoon causes the north equatorial current to flow in an east-west direction, while the south-west monsoon in summer

causes the same current to flow in the opposite direction. The south equatorial current is formed in a similar way to that of the Atlantic.

*Waves.*—Even when the sea is calmest, the water is not still. In stormy weather the seas are choppy and sometimes the water is thrown into huge waves: this is due to the wind. There is also the regular change in the level of the water, seen along the coasts and in the mouths of rivers, which we know is due to the rise and fall of the tide.

It is not easy to frame a definition of a wave, but most people are familiar with its form. We may compare it in shape with an earth-wave: the down-fold and up-fold are not unlike the syncline and anticline of the land surface. The lowest part of a wave is called the trough, the highest part, the crest; the length of the wave is measured from crest to crest. Waves move forward in the direction in which the wind is blowing, but the water itself does not move forward with the wave. If from the sea-shore a rubber ball is thrown to sea, well out of reach of breakers, the waves do not bring it to shore. It bobs up and down, but remains at the same place unless blown by the wind or carried along in some current. If one end of a rope is held, the other end being fixed, waves may be made to travel along the rope, by a sudden up-and-down movement of the arm; waves travel through water in much the same way as along the rope. During storms along the coast, the waves may rise to great heights, but in the open ocean they seldom exceed 45 ft. When viewing big waves from a ship, one is inclined to get an exaggerated idea of their size, as the vessel is continually dipping down into the troughs of successive waves. The surface of a wave is not always smooth, the crest sometimes being broken. As a wave approaches the shore, the crest may become a line of foam, forming a breaker. This happens with each succeeding wave. The front of each wave, being in shallower water than the back, is checked, and the back gains on it; thus the crest is pushed up until it is so steep that it falls forward. For a long line of breakers to be formed, the shore must slope gently seawards. If the coast is steep the wave may not come in parallel to shore, but at an angle, which is determined by the direction of the wind. In this case the waves do not break until they hit the cliff or sea-wall, when they are thrown forward and upward. The depth of the water has considerable influence on the

movement of waves and also on their size: it is important to remember this when considering the action of the tide along coasts.

*Tides.*—It is not difficult to see that there is a connexion between the tides and the moon. The tide is highest when there is a new or full moon. According to the law of gravitation, there is a mutual attraction between the earth and moon—in fact between all bodies of the universe. The pull or attraction between any two bodies varies inversely as the square of the distance. In the figure the point B is nearest the moon M, therefore the pull is greater at this point than elsewhere on the earth; and at A the pull is smaller than at O, the

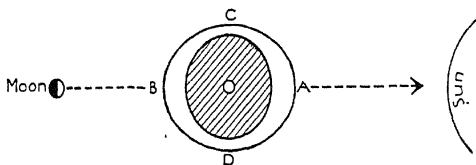


FIG. 179.

centre. The solid part of the earth is affected little by this attraction, but the liquid part, formed by the oceans, yields to the pull. The result of this will be more easily understood, if we consider for the moment the case of an earth completely surrounded by water (as shown in the figure). The attraction at B is greatest and the water bulges towards the moon, forming a huge wave. At O the pull is less, but at A it is smaller still, so that here the water bulges away from the moon to form another huge wave. Put in another way, it means that at B the water lags behind, being held up by the pull of the moon, which is strongest here. At A the attraction of the moon is weak, and the water is thrown outwards, away from the moon, by the swirling motion caused by the earth rotating on its axis. This centrifugal force, as it is called, is present at every point on the earth's surface. At B, the centrifugal force is weaker than the tide-raising force, but at A it is stronger. Swing a weight round and round on the end of a piece of string, and you will get a good idea of what centrifugal force means. The tides, then, consist of two huge waves at opposite sides of the earth. The water has been drawn away from other parts, and there the level is low, as at C and D. As the earth spins on its axis, any point on the surface

comes under two high tides and two low tides in 24 hours. But as the earth rotates, the moon moves round in the same direction, and for the same point to be again opposite the moon it must turn a little farther. It takes roughly 50 min. for the earth to turn this extra bit, so that the interval between two high tides is not 12 hours, but roughly 12 hrs. 25 min.

As there is gravitational attraction also between the earth and sun, the sun has an influence on the tides. But owing to its much greater distance, the tides caused by the sun are much smaller than those of the moon. The sun is in a fixed position in relation to the earth, consequently the tides caused by the sun occur at the same time every day: the interval between the sun's high tides is exactly 12 hours. When the two high tides—that of moon and sun—coincide, we have spring tides; when high tide, caused by the moon, coincides with the low tide of the sun, neap tides. Therefore spring tides occur when the earth, the sun, and the moon are in the same straight line, which is at full moon (as in Fig. 179) and new moon. When the position of the moon, from the earth, is at right angles to that of the sun, as it is at half moons, the sun's low tide counteracts the moon's high tide, giving neap tides.

If the earth were completely surrounded by water (as we have supposed in our example) all places in the same longitude would have high tide at the same time. But this is not the case. The estuaries of the Severn and the Mersey are roughly in the same longitude, but their times of high water are very different. The tidal wave tends to travel round the earth from east to west, but the great land-masses prevent this. Only in the southern ocean is there a clear passage for this wave where it can travel round the globe. As this wave passes the entrances to the oceans, it sends branches into them. It is sufficient for our purpose, if we consider the movement of the wave in one of the oceans. The movement of the wave in the Atlantic Ocean is shown in many atlases. The numbered lines are called co-tidal lines: all places on any one co-tidal line have high tide at the same time. The form of the wave in successive positions is not so simple as shown on the map. The map shows that the wave travels more rapidly in mid-ocean than near the shore, and where the shores approach one another, as at the Equator, the wave slows down. In the North Atlantic the centre of the wave goes

forward rapidly, and the wave approaches Europe from the south-west. In the ocean the speed of the wave depends chiefly on the depth of the water : in deep water it moves rapidly ; in shallower water, near shore, slowly. In mid-ocean there is no ebb and flow of tide such as is found around the coasts, but only a rise and fall of 2 or 3 ft.

On reaching the shores of the British Isles the tidal wave is divided into three portions by Ireland and the Cornish peninsula. The main portion travels along the west coast of Ireland, around the north of Scotland, and passes from north to south along the east coast of Britain. Of the two smaller portions, one travels up the Irish Sea, the other up the English Channel. A map of the co-tidal lines of the British seas shows that the tide travels very slowly in these seas compared with the Atlantic Ocean. In the shallow water of these seas, friction with the sea-bottom impedes the wave. We have already pointed out that when a wave enters shallow water, the back gains on the front, and the height increases, and the crest of the wave behind closes up to the wave in front. For this reason the tides are high in British seas, the difference between high and low water in many places being as much as 30 ft. and in a few places occasionally 40 ft. Exceptionally high tides are found in gulfs and estuaries, which narrow inwards. The wave becomes higher and higher as it travels into a continually decreasing space. When a tidal wave is retarded suddenly, the back of the wave gains on the front, and the front is pushed up. If the front falls forward, a line of foam is formed as in the breaker of the seashore. This occurs most frequently in the mouths of rivers, where the current slows down the tidal wave suddenly : a good example is the Severn. The crest of the wave falls forward and the result is a line of foam, which moves up the river. The front of the crest is called a bore or eagre : that of the Severn is 3 or 4 ft. high at spring tides ; the Tsian-tang-Kiang in China has a bore 12 ft. high.

In the British Isles some places have unusually long periods of high water, for example, Southampton. This is because the tide can enter from two directions : it first enters by the Solent, and two hours later by Spithead.<sup>1</sup> Although a tide reaches London from the north and another from the south, the period between two successive

<sup>1</sup> Part I, Fig. 16.

high tides is normal, because both arrive at the same time. But this causes exceptionally strong tides in the Thames, and is important, for the tide helps to keep the river's estuary free from sediment. As the tide rises the current of the river is held up, stopped, and perhaps reversed; when the tide falls the current, released, flows out with great strength and takes sediment with it.

### OCEAN ROUTES

Ships travel the seas in the pursuit of trade between so many ports, and by so many routes, that a study of them all is impossible. Yet we can get a good idea of the main lines of ocean traffic in a simple way, by considering, principally, those lines which lead from Britain, and from some of the chief ports of western Europe, and are followed by the largest 'liners'—the steamers which sail between certain definite ports, as distinct from the 'tramps' which go wherever they are sent for trade. We may mark out our main lines in this way:

- (1) The crossing of the North Atlantic Ocean from Britain (and Europe) to eastern Canada and the United States of America.
- (2) The crossing of the Pacific Ocean, from western Canada and the United States to eastern Asia and Australia.
- (3) The routes to the West Indies, the neighbouring mainland, and the Panama Canal; thence to western South America and across the Pacific (New Zealand).
- (4) The routes to eastern South America (Atlantic Ocean).
- (5) The routes to the African coasts, and around South Africa to Australia.
- (6) The routes through the Suez Canal, to India, eastern Asia, and Australia.

(1) On the North Atlantic crossing there sail the biggest ships in the world, among many others—so many, that ships sailing westbound and eastbound follow different 'lanes' or courses for safety's sake: these lanes lie more southerly during the cold season than in summer, though the southerly routes are slightly the longer. Southampton and London, Liverpool and Glasgow are the ports in Great Britain chiefly concerned with this traffic—Southampton, in particular, with the biggest and fastest passenger ships.<sup>1</sup> Plymouth

<sup>1</sup> Part I, p. 50.

also is used for passenger and mail traffic. Some ships from Glasgow and Liverpool call for Irish traffic at Moville or Belfast ; some from Liverpool and Southampton at Cobh in the south of Ireland. Many of the Southampton ships get French traffic by calling at Cherbourg ; some from London, and also from Germany (Bremen, Hamburg) call for French traffic at Boulogne. Big French liners themselves sail chiefly from Havre. On the American side, the port of New York far exceeds all others in importance ; in Canada, the chief summer ports are Quebec and Montreal on the St. Lawrence ; those of winter, Halifax and St. John.<sup>1</sup>

(2) Railway routes across the North American continent connect the North Atlantic ocean routes with those across the Pacific. From the ports of eastern Canada the Canadian Pacific and Canadian National railways run to Vancouver ; from New York the United States may be crossed by way of Chicago or St. Louis or New Orleans to San Francisco.<sup>2</sup> These form parts of passenger routes between Britain and Europe and eastern Asia ; but not for commerce between those countries, for it would not be worth transhipping goods in large quantities from steamer to railway, and again from railway to steamer. The trans-Pacific steamers sail mainly from Vancouver and San Francisco ; some from Seattle ; and those from Vancouver or Seattle call at Victoria on Vancouver Island. The Pacific islands affording the chief ports of call on the way across the ocean are Honolulu and Fiji, Samoa, and Tahiti, and the main Pacific lines continue either to Japan (Yokohama, Kobe, Nagasaki), China (Shanghai), Hong-Kong, and Manila, or to New Zealand (Auckland or Wellington) and Sydney in Australia.

(3) A group of important routes converges upon the West Indies, including those to the islands themselves, to the southern United States ports (New Orleans, Galveston), and to Mexico, Central America, and northern South America, including British Guiana ; also to the Panama Canal. In addition to the British ports previously mentioned reference should now be made to Bristol, a port specially concerned with West Indian trade. Hamburg and Bremen, Boulogne, Havre, and Bordeaux all have important services to the same part of the world ; and here also should be mentioned the connexions between Canada (eastern ports) and the West Indies,

<sup>1</sup> Part I, p. 316,

<sup>2</sup> Part I, pp. 322, 329.



which have a substantial exchange of trade, and between New York, the islands, and the mainland ports. As for the Panama Canal (Part I, p. 334), the most important lines using it, for the purpose of our present sketch, are those between England and the west coast ports of South America, between England and New Zealand, between the east and the west of the United States (e. g. New York to Los Angeles and San Francisco), and between New York and western South America (e. g. Callao and other ports southward to Valparaiso).

(4) The lines from the British, German, and French ports to the east coast of South America have the chance to call at Spanish and Portuguese ports, and the islands of Madeira and the Canaries. The chief Spanish port in this connexion is Vigo—and its position on the map shows the reason—the Portuguese, Oporto and Lisbon. Some French ships sail as far south as Dakar in French West Africa before striking across to South America. One line of steamers sails from Liverpool by Oporto, Lisbon, and Madeira to Para and up the river Amazon to Manaos. Others coast along the South American seaboard, the principal ports visited being Pernambuco, Bahia, Rio, Santos, and Montevideo and Buenos Aires on the Plate estuary. There is important traffic also along this line of ports from New York.

(5) Madeira and the Canary Islands, mentioned above, serve also as convenient ports of call for ships between British and other northern ports, and Africa. The fastest steamers to South Africa (Cape Town, Durban) sail by the western route, not through the Mediterranean Sea and by the eastern route; nor do they follow the incurve of the Gulf of Guinea. But there are other steamers which coast along Africa, both west and east, trading at a succession of ports. Some ships make the complete circuit around the continent. Another important line, after reaching Cape Town by the western route, continues across the Indian Ocean to Australia.

(6) Lastly we consider the highway of the Mediterranean Sea, the Suez Canal, the Red Sea, and the Indian Ocean, in their relation to the lines to India, eastern Asia, and Australia. From Britain and northern Europe this is not a very direct highway, as ships are forced to sail around the west of the continent, and through the gateway of the Straits of Gibraltar, to enter the Mediterranean. Passengers

from England often travel across France to Marseilles or to Toulon, or to Naples in Italy, and there catch up the steamers which have sailed from England a week earlier. Nevertheless, this sea highway is shorter than that around South Africa, and we have gathered from Part I (p. 279) the tremendous significance of the Suez Canal—the ‘big ditch’ through the isthmus of Suez—in this connexion. And here it may be noted, in connexion not only with the present group of routes but with others mentioned before, that the main Mediterranean ports for ocean traffic are the Italian port of Genoa and the French Marseilles, to which may be added Trieste and Naples in Italy, and Barcelona in Spain.

On leaving the Red Sea and entering the Indian Ocean, ships go their different ways according as they are bound upon the east African route mentioned in the previous section (5), or to the Persian Gulf or the Indian ports of Karachi and Bombay, or to Ceylon (Colombo). From Ceylon routes diverge again (*a*) into the Bay of Bengal, as for Madras, Calcutta, or Rangoon (Burma); (*b*) eastward to the Strait of Malacca, for Singapore; (*c*) for Australia (Fremantle, for Perth in Western Australia, Adelaide in South Australia, Melbourne in Victoria, Sydney in New South Wales, Brisbane in Queensland). From Singapore, again, routes diverge, either for the coasts of Siam and French Indo-China, for Hong-Kong, and for Chinese and Japanese ports, or for the Philippine Islands (Manila) or the islands of the Malay Archipelago (Java and others).

It is a dull list, this. Yet any who can read it with a remembrance of lands and places in mind may be helped to arrange and study further the great courses of the world’s commerce overseas, and to feel something of their manifold interests.

# NATURAL REGIONS OF THE WORLD



## XVII. NATURAL REGIONS OF THE WORLD<sup>1</sup>

IN describing the surface of a country, or a continent, we are used to dividing it according to the natural divisions—lowlands, uplands, mountain-systems, river-basins. In the first part of this book we divided Great Britain into lowlands and uplands or highlands; and then, when we described the surface more closely, we found that a number of smaller natural divisions could be made. So with Europe: the natural divisions of the surface of the continent are made at first, broadly, into northern plains, central uplands, southern mountain-systems, the great peninsulas, and so forth; but when we describe the several countries of Europe, it is possible to divide each of them into still more surface-divisions. In Part I we did this, for example, with France, describing its surface in eight divisions. Again, in discussing climate, we found contrasts between the west of Britain and the east, and in Europe between west and east, north and south. And natural division of this sort may be carried into close detail, if we know enough about a country and have time to study it closely. For instance, any one well knowing even such little hills as the Downs in south-eastern England, can recognize differences of structure and soil, of vegetation, and even of climate, between the land at the foot of the hills and at the top. But our purpose now is not to add to such details as we already know, but to see how far they contribute to some sort of order in which we can recognize great controlling natural features of surface-relief, climate, and vegetation, in various parts of the world, as affecting the life and activities of man. Is there not enough in common, as regards natural features, between the British Isles and western Europe, to view them together as a single 'region'? Have we not found, in different parts of the world, lands in which the climate and vegetation so closely resemble those of lands neighbouring to the Mediterranean Sea, that we label them all as 'mediterranean' regions?

This is the idea: that the lands of the world can be divided into regions—not a large number—which can be classified according to

<sup>1</sup> Parts I and II, when issued as separate volumes, both contain this

particular features of relief, climate, and vegetation, which predominate in each class. It is suggested in Part II, p. 422, that it is valuable to have an outline map of the world in the mind's eye. We are aiming now at a map with certain divisions upon it—the greater natural regions of the world—to be carried in the mind's eye and to help in arranging in the mind the mixture of knowledge collected during the study of geography.

A world-map, coloured according to such divisions, is given in this book. Most of the regions are divided one from another by boundary-lines on the map. It should be understood that boundary-lines in nature are rare. The upper limit of trees on a high mountain may be quite a clear-cut line. There are parts of the world where a traveller may pass almost suddenly from natural forest to natural grass-land. More usually, the change from one set of natural conditions to another is gradual. But a little map of regions without boundary-lines would be difficult to read. It will be noticed, however, that no boundary-line appears between western and eastern Europe. This is meant to suggest that the changes in climatic and other conditions across Europe from west to east are very gradual: sometimes, indeed, another region, transitional between west and east, is marked on regional maps. For a regional division of the world must necessarily be so far generalized, that it may be made in different ways. We spoke just now of features which predominate in each class of region. An example will illustrate the meaning of this. The greater part of the Amazon basin is forested; therefore it is classified with the forest regions of the hot lands. But a large part of the basin is savanna land; and different maps may show the boundaries of the region differently. That need not trouble us. However, anybody who studies the regional divisions given below may find that some of the regions might be divided otherwise, and may prefer to do this. So much the better. A division worked out for oneself, so that it be justified, will still better help the ordering of one's own knowledge.

The grouping of the regions on the map is seen to accord with the cool, warm, hot, and cold belts of climate. The cool belts come first; in them man's highest civilization is most widely developed, though it extends far into the warm belts. The connexion between climate and regional division is suggested again in the use of the words

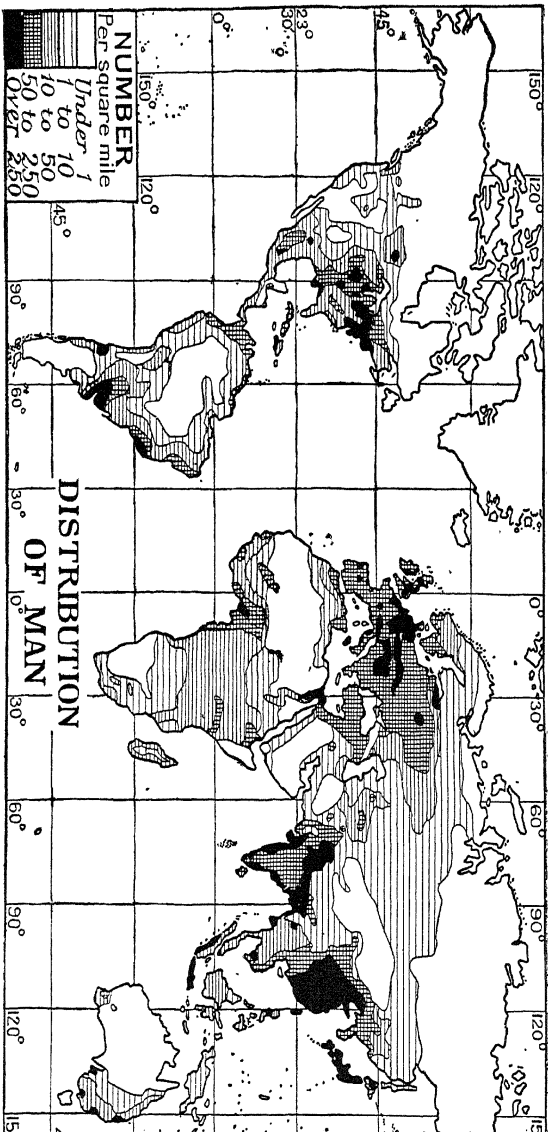


FIG. 180. DISTRIBUTION OF MAN, OR COMPARATIVE DENSITY OF POPULATION. A comparison with the map of natural regions of the world is worth making.

## Natural Regions of the World

'fringe' and 'interior'.<sup>1</sup> The 'fringe' lands—also called marginal—border the coasts of the continents, but they extend, in some instances, too far inland to be termed coastlands. Divisions according to relief—lowlands and highlands—are also suggested by some of the descriptions of regions; in others, again, vegetation appears as the feature which gives a region its name. Let us now examine the regions severally.

### (I) COOL REGIONS

'*West Fringe*' Regions (1 a). By far the most important region of this type is western Europe, including the British Isles. The features which define these regions are their position in relation to the sea, and therefore their climate. This is equable, under the influence of prevailing westerly winds from over the sea, and, under the same influence, rain falls at all seasons, with little if any distinction between the seasons in this respect. The European region is of varied height; the highest lands are mainly in the south, so that to some extent the temperature is equalized (it should be clear why this is so). In the east the summers are hotter and the winters colder than in the west; but the climate is never extreme. In the most northerly parts of the region (Scandinavia) and on mountains farther south, the birches and coniferous trees, characteristic of the cold northern forest (4 a), are found. The conifers, of which the needle-like leaves endure the hard winters of high latitudes or elevations, form most of the forests of Scandinavia and of the higher uplands of central Europe. We recall the names of the Bohemian, Thuringian, and Black Forests as examples. The lowland forests consist of broad-leaved trees, such as oak, ash, elm, and beech, called deciduous because their leaves fall off in winter. The lowland forests have largely disappeared as in the course of centuries the large populations of highly civilized states have cleared them for agriculture, and developed extensive mining and manufacturing districts. Cereals are the chief crops, together with potatoes and sugar-beet, and among fibre plants flax and hemp, especially in the east of the region. Sheep are kept mainly on hill pastures, cattle on richer lowland pastures, though this distinction is not very exact. This region is one which has sent out vast numbers of its white peoples,

<sup>1</sup> Part II, p. 468.



advanced in civilization, to develop new lands as emigrants. Even so, it includes the leading examples of lands (including the British Isles) which must import much of the foodstuffs needed for the many millions of population who cannot grow their own, and raw materials for their manufactures.

The other regions of this type are less extensive, less varied in surface, and have a much shorter history of development by white men, than the European region. The south island of New Zealand, which may, broadly, be classified here, offers the nearest general comparison, and one of high interest in regard to the future of this dominion of the British Empire. The type is found also in Tasmania, and along the west coast of North America (mainly British Columbia) and the south-west coast of South America. The two last coasts, together with part of that of New Zealand, are compared with that of Norway (Part II, p. 461) in respect of their deep fiords, many islands, and high forested mountain-flanks. On the northern edge of the region lies a part of the island of Iceland, principally the south-west, which shares with northern Norway the warming effects of the Atlantic drift, in opposition to the Arctic cold.

'*East Fringe*' Regions (1 b).—The examples of these are in eastern North America, eastern Asia, and the south-east of South America. In North America the greater part of the St. Lawrence basin is included, and it will be noticed that the boundary of the region turns south from the neighbourhood of Lake Ontario, to include part of the Appalachian highland, and the New England division of the United States. Here is illustrated the cooling influence both of highlands and of the sea; the cool temperate belt extends farther south along the eastern coasts of North America and Asia than along the western coasts of North America and Europe (cf. Part I, pp. 83, 197, 304). The winters in these 'east fringe' regions are much colder than in the 'west fringe' regions: this is the most strongly marked difference. On the whole, too, there is less rain in the eastern regions. Both in North America and in Asia the coniferous forest extends far south into these regions. The South American region (Patagonia) is peculiar in being sheltered from heavy rainfall by the Andes to the west (Part I, p. 346). Economically the North American region is by far the most important of the three, including as it does the great ports and commercial centres of New York, the

north-eastern States, and eastern Canada—divisions of the New World the longest and among the most fully developed by white men, of European origin. The yellow peoples native in eastern Asia, and the comparatively few white immigrants, have progressed not nearly so far in the Asiatic region. The same is true of Patagonia, where the natives reach no high standard of civilization, and white immigrants are not many, for the region offers less chance of development than the other two.

*Interior Lowlands* (1 c).—These have a wider extent in Eurasia than in North America. In both the climate is extreme, with hot summers and long cold winters ; while the rainfall grows less toward the east in Eurasia, and toward the west in North America. The Eurasian region is reached, as we saw (p. 510), by a gradual transition from the European ' west fringe '. It extends across eastern Europe and across Asia to the highlands of eastern Siberia, and similar conditions are repeated in Asia, eastward of the dry central plateau and between this and the eastern ' fringe '—that is to say, approximately, in the plains of Manchuria. In eastern Europe the region extends, at its widest part, from the Black Sea to the Gulf of Finland. The transitional country (centring, say, in Poland) between the western fringe and the interior lowland is partly forested, partly grass-land ; and the Transylvanian mountains may be placed in this area : on the other hand, the middle and lower plains of the Danube rank with the plains of the Russian lowland. The interior lowlands, generally, consist of grass-lands—steppes in Russia, from which country the word is used more widely : prairies in North America. The northern boundary, both in Eurasia and in North America, may be determined along the zone of a change in vegetation : that is, the northern limits of the grass-land and the southern limits of the northern coniferous forests. The Eurasian region includes that most fertile agricultural area, the Black Earth district of Russia ; the Canadian prairies are of still greater importance, at least as British territory, for their wheat-farming. The Canadian lands have been, and continue to be, developed by immigrants both of British stock and of various other European nationalities ; the development of the Eurasian region, less advanced in many respects, is practically all in Russian hands (Part I, p. 221). The keeping of live stock takes the place of cultivation in the driest interior parts of these regions (cf.

p. 519). In the Manchurian region, Chinese farming has enabled the export of soya beans and other producè.

*Interior Highlands and High Plateaus* (1 d, e).—The cool interior highland regions marked on our map are in north-central Asia, in south-central Europe, and in the north-west of North America. The Altai is the principal mountain-system in the Asiatic region, the Alps in the European ; the North American region forms a part of the Rocky Mountain (western) system, mainly in British Columbia. In North America, it will be noticed, we are dividing the western mountain system partly by regarding climate as the determining factor (as in regions 1 a, 2 a), and partly in accordance with height, in distinction from the interior lowlands. On the other hand, the interior plateaus (1 e) shown in central Asia (Tibet) and South America (the Andes) owe their position to both factors. We classify them with cool regions, although their latitudes are the same as those of warm or hot regions, because their great height gives them a cool climate.

When considering the highland regions it should be remembered that smaller areas showing similar characteristics may be found in other mountainous lands. The Himalaya mountain system has been given (Part I, p. 234, and Fig. 68) as an example of the successive zones of vegetation found from the foot of the mountains upward to the snow-line. The lowest zone of vegetation on a mountain is like that of the surrounding country, and above this, except in very dry regions, the higher zones roughly resemble the successive lowland belts between the mountain and the pole. The comparison, it should be added, is better made with the eastern fringes of the continents than the interiors or western fringes ; for that helps to avoid the desert belts which have no counterpart in the mountain zones of vegetation.

In mountainous regions generally, communications are difficult ; and this is illustrated, on the one hand, by the simple forms of transport—by pack animals or even by porters—used in such regions as central Asia and parts of the Andes, and on the other hand by the wonderful works in railway construction, tunnelling, and bridging, seen in the Alps and in British Columbia. Cultivation is possible only in the valleys. As for the pasturing of live stock, a usual feature, which may be illustrated from the Alps and also from Norway, is

the movement of animals between the low ground where they are fed in winter, to the high pastures in summer, where sometimes the people have summer dwellings and carry on dairy work. The mineral wealth of some of these high regions is great : it has been well developed in British Columbia and on the Andean plateau ; less fully in the Altai region of Asia. There is a natural tendency for the inhabitants of mountainous regions to live, each group in its own valley, without much communication with other people. The extreme example is found in Tibet. The Tibetans, most remote of the yellow peoples, until modern times had hardly any relations with white men, whom they did their best to keep out of their country. The Alpine state of Switzerland is a federation of a number of what may be called valley groups of people who still speak different languages. In days of old, mountain peoples used sometimes to learn of the richness of lowlands beyond their mountains, and raid them ; history gives many examples. In modern times some mountain lands—the Alps very specially—draw visitors from countries where there are no mountains to enjoy their holidays.

## (2) WARM REGIONS

The warm temperate lands of the northern hemisphere not only form belts across Eurasia and North America, but are extensive in the southern hemisphere, which the cool temperate lands are not, on account of the small area of land in the higher latitudes of that half of the globe. These warm regions are warmer both in summer and in winter than the cool regions, except at great heights and in the interiors of continents, where the climate may be very extreme, with intense summer heat and winter cold. Rainfall varies in amount and season. The western regions have rain mostly in winter, the eastern in summer ; the interior regions are in large part almost without rain. Where rainfall is enough, or irrigation can be supplied, the cultivated products are many and rich.

*The Mediterranean Fringes (2 a).*—These are the western fringe regions of the warm belts. We have found them to have warm summers, mild winters, and winter rains. They are named from the coastlands of the Mediterranean Sea (except where that sea is bordered by the north African desert). In western North America the mountains limit the area under ‘ mediterranean ’ influence, and

it is confined to the valley of California ; so, too, in South America, it is limited by the Andes to the narrow seaward strip of central Chile. Similar regions are found in the western part of Cape Province in South Africa, the south-west of Western Australia, and the south of South Australia and Victoria (the seaward face of which is also south-westward). The north island of New Zealand resembles these in general conditions.

The mediterranean lands have warm summers, mild winters, and winter rains. The vegetation is suited to these conditions : plants root deeply, so as to collect moisture the better during the dry summer ; for the same purpose they have small thick leaves and other characteristics which help them to keep moisture within them during drought. Most are evergreen. When rainfall is sufficient, chestnuts and walnuts are typical trees, and in the drier parts, evergreen oaks. A vegetation of small bushes and shrubs is common in the lands around the Mediterranean Sea. Natural grass-land is not common. Maize and millet to a large extent replace wheat as grain crops except on the higher lands. Cotton appears. The olive and mulberry, the fig, orange, and many other good fruits are grown, and the vine is important whether for making wine from the grapes, or drying them as raisins, or (in Greece) as currants. On account of their importance in the European mediterranean lands certain of these plants—the vine in particular—have been introduced and flourish equally well in other mediterranean regions. For these are all regions of development by highly civilized white peoples, of whom large numbers have emigrated from the European countries, not only the Mediterranean countries themselves but also those of the cooler lands. To many of those who suffer from (or merely dislike) the harder or darker winter of the cool belt, the mediterranean lands, of Europe and California in particular, offer health or enjoyment at that season.

It may be noted that in the map the region of the Mediterranean Sea is shown to extend into the lowland plain of the rivers Euphrates and Tigris, and the climate is influenced there by mediterranean conditions to some extent ; but if it were not for the rivers, drawing their waters from the mountainous region to the north, this land would be added to the adjoining desert.

*'East Fringe' Regions (2 b).*—In eastern Asia (northern China,

southern Japan), in the United States of America, in the Plate basin of South America, in South Africa (Natal, &c.), and in the southern coastlands and highlands of eastern Australia, we find regions where the rainfall is chiefly in summer. The Asiatic region is to be regarded, on that account, as the northward extension of the monsoon lands of that continent (Part I, p. 200). Temperature conditions, however, vary considerably between these regions. The Asiatic region has a vast land-mass to the west of it, and prevailing winds in winter blow outward from this ; therefore the winters are cold, and in the north of China, at the same latitude as the warm winter health resorts of the Mediterranean lands, the rivers may be frozen at that season. The summers, however, are hot. The North American region has hot summers and cool winters, but in the ' east fringe ' regions of the southern hemisphere the winters are warm. In the northern regions such crops as rice, sugar, and cotton are important, with maize especially in North America, and tea in parts of the Asiatic region. To some extent similar crops have been introduced in the southern regions, as for example tea in Natal. As the summer heat is accompanied by rain, the natural vegetation is rich, and typical forest trees are broad-leaved (walnut, oak, beech, &c.), not having thick small leaves like the trees of the dry-summer Mediterranean lands. An evergreen undergrowth is common. Toward the south in the northern regions, toward the north in the southern regions, the vegetation merges gradually into that typical of the hot belt. The Asiatic region includes the most closely settled and cultivated agricultural lands of the yellow peoples, Chinese and Japanese. The North American region, a white man's land, contains also most of the negro population of the United States, especially in the south. The regions in the southern hemisphere are lands of settlement and development by people of European birth or origin ; but in the South African region there are also emigrants from India.

*Interior Lowlands* (2 c).—In Eurasia the drier steppe lands extend from the Black and Caspian Seas to the edge of the Tian Shan mountain system. Parts are almost desert. The steppes here and in the cooler region to the north still have nomad peoples who wander with the animals on which they live, from one stretch of poor pasture to another. The North American region covers much of the western part of the Mississippi basin, up to the eastern slopes of the Rocky

Mountain system, and is the chief seat of the ranching occupations (the rearing of live stock) well known in its connexion with the 'Far West'. The South American region includes much of the grass-lands of Argentina, famed for cattle and other live stock. The Australian region, extending inland from the south-eastern highlands, contains some of the best sheep-grazing land in the continent. No region of this type is marked in South Africa, since the plateau of the veld rises steeply from the coastal lowland in Natal. In all these regions cultivation is done with the help of irrigation.

*Interior Highlands* (2 d).—A broad belt of plateaus stretches across Asia from the Mediterranean fringe in Asia Minor, through Iran, to the frontiers of China and Manchuria, except at the high but comparatively narrow belt of mountains between north-west India and Russian Turkestan. Many mountain ranges, also, rise above the plateaus. Rainfall is scanty and the climate extreme. Great part of this region is desert, even in the north-east (Mongolia) where the summer is not so hot, and the winter, as over so much of interior Asia, very cold indeed. Here and there are fertile valleys of streams flowing from the mountains; but many of these dry up in desert sands or are lost in marshes. The other principal regions of this type are in the southern interior part of the Rocky Mountain system, extending through the United States and into Mexico, and on the plateau of South Africa. Neither of these regions is so large as that in Asia, and neither is so dry. Higher slopes of the Rocky Mountains within the North American are forested. In both regions cultivable and pasture lands are important, and there are no extensive desert tracts. And the distinction is very clear between the modern development, by white immigrants, of the North American and South African regions on the one hand, and, on the other, the unchanging and in some cases primitive lives of the Asiatic peoples in the lands of this type.

### (3) HOT REGIONS

We have observed <sup>1</sup> the conditions under which the rain belt, in the hot middle zone of the earth, follows the apparent movement of the sun north and south during the year, crossing the Equator twice. About the Equator, though rain falls at all seasons, there are two wet

<sup>1</sup> Part I, p. 260; II, p. 480.

seasons, and two less wet. Northward and southward, rain falls only in the summer months, and the year is divided into a wet and a dry season. In the trade wind belts rainless regions are found where these winds are dry. In the tropical lowlands the temperature is always high, but at high elevations it is cooler and may be very cold in winter; and it is on high mountains in the equatorial belt that the greatest range of different types of vegetation within a short distance, from the foot to the snow-line, may be found.

*The Monsoon Fringe.*—Broadly speaking, the lands of this type receive winds from the sea in summer, the wet season, while winter is a dry season, with winds from the land. These seasonal winds are called monsoons. They are most clearly developed in India and south-eastern Asia; less clearly southward in parts of the Malay Archipelago and the north of Australia, and over the south-west uplands of Arabia, and the coastlands and the Abyssinian highlands of East Africa. In the New World, the region of Central America and the West Indies corresponds to the Asiatic region, but the monsoon conditions are not nearly so strongly marked; the coastal strip of eastern South America corresponds to that of East Africa. The vegetation varies greatly according to amount of rainfall and other conditions; thus in northern India alone we find variation from the jungle of the Ganges delta and the foot of the eastern Himalaya, to the arid vegetation on the borders of the desert of Thar. In Mexico and Central America we recall the differences of natural vegetation and cultivated plants, at different heights from the coastal lowland to the high plateau, and the common division into hot, temperate, and cool lands according to height. The monsoon lands of Asia, especially where rice is the staple food-crop, have an extremely dense agricultural population numbered in hundreds of millions, of Indians, Chinese, and the kindred peoples of the Indo-Chinese peninsula. There is a dense negro population on some of the West Indian islands. Islands, like mountain-valleys, form the homes of people who are kept naturally in separate communities, and this may be noticed here as a geographical reason why the British islands of the West Indies have never been brought together under one government.

*The Wet Forests* (3 b) cover most of the equatorial lowlands, receiving heavy rains throughout the year, in the Amazon basin of



South America, and the Congo basin and coast of the Gulf of Guinea in Africa. The vegetation of these tropical forests is varied and dense almost beyond the understanding of those who have not seen them. Trees are crowded together, hung with climbing plants, and set about with undergrowth through which men must cut their way with difficulty. In regard to population, therefore, these lands are at the opposite extreme from the thickly inhabited agricultural lands of the monsoon region in Asia. The people of the forests are few and primitive, draw their simple needs from the forest itself, and come seldom into touch with civilized man, except where white people employ them to collect rubber and other forest produce for trade. The tropical forests of the Malay Archipelago and New Guinea, which are in great part mountainous, have on that account different characteristics as between the trees and plants of lowlands and highlands. And it is noticed in the archipelago that while the people of the interior forests are primitive, like those of the Congo and the Amazon, where they seldom if ever see more civilized men, the native Malays of the coastlands, not confined to simple forest life, are traders and sailors, and much more highly advanced.

*Savanna-Steppe* (3 c).—North and south of the tropical forests in Africa and South America there are wide expanses of savanna—grass-land dotted with trees, from which features the name of ‘park-lands’ is sometimes given to these regions. We reach now the zones of summer rainfall and dry winter seasons. There is a similar region in the north and the eastern interior of Australia. The population of these regions, as in steppe regions noticed already, is small for the area. The rearing of cattle on the better grass-lands is to be noticed in the Australian and South American regions. In Africa and Australia these regions merge into those numbered (3 d); the rainfall becomes less and less, trees fewer, grass drier and more scanty, as we pass from rich to poor steppe-lands.

*Steppe-Desert* (3 d).—We mark the transition just noticed by the names given to this and the preceding type of region. Poor steppe-land merges into desert, not only in Africa, but along the borders of the other deserts shown. The biggest region of this type is in North Africa (the Sahara, &c.) and Arabia; we have also the arid lands in north-west India, the south-west of North America, the middle-western coastal belt of South America, the Kalahari desert in south-

west Africa, and part of the interior of Australia. All lie within the zones of dry winds, on or toward the western sides of land-masses. All are lowlying, at least for the greater part, and vary in extent with the extent of land eastward of them; the American deserts also are limited by the western mountain systems. The surface consists of bare sand-dunes, save where thin grasses cover it in part, or thorny shrubs or cactus grow here and there where their roots can reach some moisture beneath the surface. The water-courses, dry at the surface (*wadis* in the Sahara and Arabia), are sometimes marked clearly by lines of poor vegetation. Where water is stored in the lower layers of the soil it may issue in springs or be reached by wells. At such points oases, or fertile patches, may be formed. The Sahara oases grow palm trees; cultivation is possible beneath their shade, and there may be a settled population. Trade is carried on by caravans following routes along which wells or oases exist. White men have overcome the difficulties of living in these very dry lands, in Australia<sup>1</sup> for the sake of their mineral wealth, and in the South American desert<sup>2</sup> in order to work the valuable deposits of nitrates.

*Highlands* (3 e).—Two high plateau regions in the hot belt are shown on the map—in East Africa, and in the northern part of the Andes. These, on account of their height, are relatively cool regions, and the African region includes lands (principally in the British colony of Kenya) where white men can settle, and have done so in considerable numbers. In the higher parts temperate crops can be raised. The high plateau of the Andes, in Ecuador and Colombia, rises to the 'cold land', as contrasted with the warm and hot lands lower down, which have been mentioned already in Central America and Mexico. Cereals are grown but do not always ripen, as the upper limit of cultivation is near.

#### (4) COLD REGIONS

*The Northern Forest* (4 a).—The zone of the northern coniferous forests extends across Eurasia and North America. We referred to it on p. 512, because its southern extension marks the transition from cool to cold regions. As a source of soft timber for use in the industries of the cool 'fringe' lands, the importance of this forest zone

<sup>1</sup> Part I, p. 374.

<sup>2</sup> Part I, p. 359.

is very great. The population of the region itself is small, for there is little chance for cultivation if the land be cleared of forest, and apart from 'lumbering' (Part I, p. 317) the natural occupation of man is principally hunting, as, for instance, for animals whose furs are valuable. The word *taiga*, of Siberian origin, is sometimes used to mean forests of this type.

*Tundra* (4 b).—This word, more commonly used than *taiga*, is also of Siberian origin. It applies to the Arctic lowlands of Eurasia and North America. The forests just described become gradually thinner toward the north, and the trees smaller, until on the tundra they disappear, and only moss and lichens, with low berry-bearing bushes, and occasionally a few dwarf trees, are seen. In the extreme north even this poor vegetation is absent. Except in the short summer, the tundra is under snow, and beneath the marshy surface which thaws out at that season the ground is frozen, so that no rich vegetation can grow. The tundra conditions are seen on our map to extend southward where the land is high, as along the Ural and Scandinavian mountains, and similar vegetation conditions may be found on high mountains anywhere, next below the limit of permanent snow. In this region man can live only in primitive conditions, and his numbers are few, for the land offers almost nothing to support him. In Eurasia the reindeer lives on one of the mosses, is tamed by northern peoples, and supplies them with food (milk and flesh) and with clothing from its skin, besides being used for transport. The Eskimo of the Arctic coastlands depend for their existence almost entirely on the sea, fishing and hunting marine animals with skill, but living in simple shelters, sometimes snow huts, under conditions of difficulty which prevent them from rising in civilization.

*The Ice-capped Lands* (4 c).—The high Arctic lands, and the Antarctic continent, are almost completely buried in ice and snow. Only along the western edge of Greenland, below the ice-cap, is there any considerable population. For the rest, these regions, of all those into which we have divided the world, most completely beat man's efforts in finding means to live.

## EXERCISES

Based generally upon Part II, but involving reference  
in some instances to Part I.

1. What is the approximate length of a degree of longitude at the latitudes of Quito, Shanghai, Land's End, Bergen? How do you account for the differences?

2. On an outline map of the world show the chief volcanic areas and name them. Underline the names of towns which frequently have earthquakes.

3. When Greenwich time is 6 p.m., give the local time of the following places: Melbourne, Calcutta, Barcelona, Fiji Islands, New York, San Francisco. What are time zones?

4. Show on a map the main steam-ship routes of the North Atlantic. Name the chief passenger ports on each side of the Ocean.

5. Describe the currents of (a) the Atlantic; (b) the Indian Ocean. Explain how they are caused (draw diagrams).

6. How do you define a Natural Region? Illustrate your answer from a division of any one continent.

7. What is meant by a contour map? Draw one to show an island rising steeply on its eastern side, and gently on its western side, to a point 600 ft. above sea-level. Insert a river valley, terminating south in an estuary two miles long. Indicate the best route for a road across the island.

8. Where are the chief chalk belts of England, and how do you account for their existence? What is meant by Karst country? Give the characteristic features of such a country.

9. Explain, with diagrams, two methods by which the relief of a country can be represented on maps.

10. What are the principal types of river-mouth? Explain the conditions under which each is formed, giving examples from the continent of Europe.

11. State how the length of day (and night) changes during the year at the Tropic of Cancer, at London, the Arctic Circle, and the North Pole. By means of tables draw a graph to represent the changes at each place.

12. Briefly describe the following: rift valley, peneplain, canyon, waterfall. Explain how each is formed, and of each give two examples.

13. Give the positions of the chief dry deserts of the world. Name them.

14. Describe (a) the action of the sea ; (b) the action of rivers, in modifying the shape of the earth's surface.

15. Compare the following types of region : Savanna lands, prairies, pampas, steppes. State where each is found.

16. Compare and contrast western Europe north of  $40^{\circ}$  N. lat. with eastern North America in the same latitude, under the headings of (a) Climate ; (b) Physical features ; (c) Economic development.

17. Describe the main physical features of a river basin and distinguish between the plain track and the valley track of the river. In what positions would you expect to find towns situated ?

18. By means of the tables given in Chap. xv draw graphs of the annual rainfall and temperature of any of the places given, e. g. the following : London, Warsaw, Semipalatinsk and Vladivostok. (Plot months horizontally ; inches and degrees vertically.)

19. In the case of the four places named in Exercise 18, use the graphs to explain the division of the cool temperate belt of Eurasia into its major natural regions.

20. Select from the tables places lying in (a) the warm and (b) the hot regions of the world and draw graphs as in Ex. 18.

21. How do the currents of the Atlantic Ocean influence the climate of the lands bordering on it ?

22. Select any one of the following regions, describe its main geographical features, and indicate how these influence the lives of the people living there : (a) the Amazon basin ; (b) the Siberian steppes ; (c) the Ganges basin ; (d) Arabia.

23. What is the connexion between winds and atmospheric pressure ? Describe a simple experiment to measure the weight of the atmosphere.

24. Define the terms isobar and isotherm, weather and climate. How are isobars and isotherms drawn on a map, and what use can be made of such maps ?

25. ' Continents become areas of low pressure in summer and areas of high pressure in winter.' Discuss this statement, and show that as applied to Africa it is only partly true.

26. Draw a diagram (with latitudes) to show the main belts of prevailing winds over the world.

27. What is meant by the apparent north and south movement of the sun through the seasons ? Show by diagrams what actually happens and so explain the use of the terms solstice, tropic, equinox, and arctic circle.

28. Draw maps to show the belts of rainfall in Africa during summer and winter, and explain how the North and South movement of the sun affects the position of these belts.

29. Explain how the distribution of atmospheric pressure in summer and in winter over Eurasia influences the distribution of rainfall at these seasons.

30. Draw a map to show the co-tidal lines of the seas surrounding the British Isles, and describe the movement of tidal waves in these waters.

31. Describe the main features of (a) the Mediterranean type ; (b) the Monsoon type of climate. What is the resulting vegetation of each type of climate and how is agriculture affected ?

32. Contrast the main physical divisions of Australia with those of South America. Do you find any features common to both continents?

33. What kind of weather might be experienced in London in winter, when a depression (or cyclone) is passing north-westward across the northern end of Scotland ? Draw a diagram to show the movement of the air in a depression.

34. Mention the different types of forest found in the cool temperate belt of North America and in the hot belt of South America. What use does man make of these forests ?

35. Describe the flora and fauna of the continent of Australia. What is Wallace's line ?

36. Show the influence of geographical environment on the lives of people living in mountain lands. Illustrate your answer by reference to the people living in Tibet, the Andes, and Switzerland.

37. Describe the features of a mountain valley which has been glaciated in the past. In what parts of the British Isles are such valleys to be found ? Also briefly describe a living glacier.

38. Draw a diagram to show the floor of the Atlantic Ocean and another to show that of the Pacific. Compare and contrast the main features of the two oceans.

39. Describe one of the following mountain systems : the Andes, the western system of North America, and East Africa. Mention the chief types of land-forms found in the system.

40. What is meant by a map projection ? Describe the features of any map projection with which you are familiar.

41. Describe the quickest steamer route from London to Hong-Kong, with reference to principal ports on the way.

42. Take any selected area important in agriculture or manufacture, and on the basis of facts given in Parts I and II, including the regional position indicated in Ch. xvii, bring together the geographical factors bearing upon the activities of man in the area chosen.

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